the OIL AND GAS JOURNAL

PUBLISHED WEEKLY AUGUST 15, 1960

The beginning is behind—the growth lies ahead in....

CANADA

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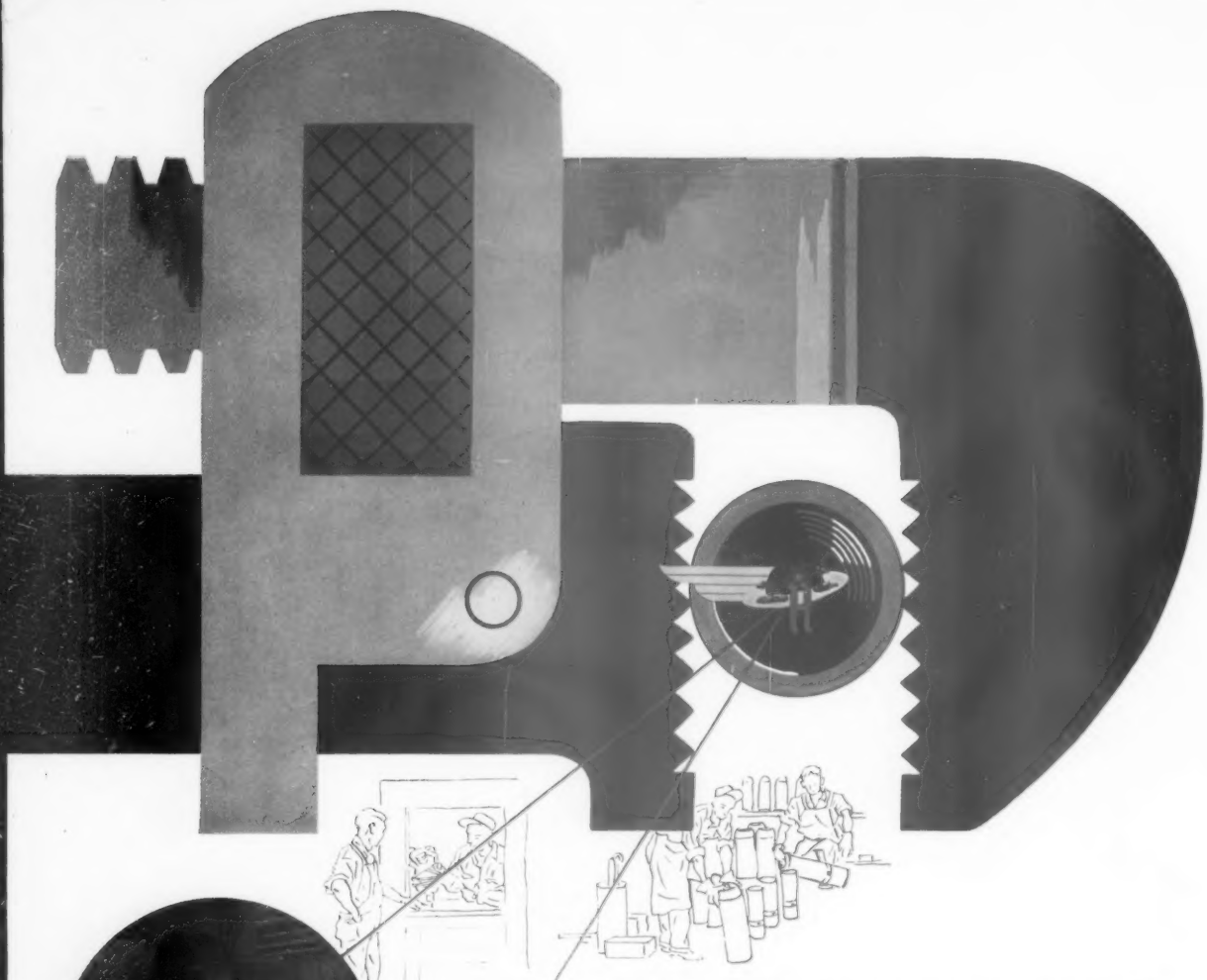
What's behind Middle East price cuts ▸ 83

Eastern independent fast going big-time ▸ 86

Scouts fight to keep jobs alive ▸ 92

Elusive Jurassic new East Texas target ▸ 98



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These are the men who apply the master craftsman's touch to every Halliburton tool you use— and, through continuous scheduled field maintenance, help keep "brand new" dependability in every unit of Halliburton's gigantic fleet of trucks, cars, ships and planes.

Dependable equipment can only result from dependable people. We're glad to have them!

HALLIBURTON COMPANY

DUNCAN, OKLAHOMA

OIL AND GAS JOURNAL
Vol. 58, No. 33

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ANNUAL CANADIAN SECTION

Gas Exports to Spur Future Canadian Growth 114

By Gene Kinney

Proposed pipelines and the imminence of natural-gas export combine to paint a flowing picture of growth for the Canadian industry. More than 8 trillion cubic feet of gas has been dedicated for export.

Canadian Refiners Are Marking Time 118

By D. H. Stormont

Excess refining capacity has caused a near holiday in new plant construction. Existing plants have more than sufficient capacity to supply current demand. The lull applies principally to new crude capacity.

Gas Will Put Canadian Operators in the Black—in 3 Years 121

By Carl O. Nickle

Since Leduc Canada has spent $4.77 billion, received $3.03 billion. Gas sales are expected to slash the annual deficit, and the first net gain is expected in 1963. But the cumulative deficit won't be erased until the 1970's.

Eastern Canada Has a New Exploratory Target—Oil in Trenton Synclines 124

By R. J. Burgess

The peculiar occurrence of oil in synclinal traps has cropped up in at least three areas of eastern Canada and southern Michigan. Because of this, the Trenton syncline has become a major exploratory target. Dolomitization along zones of weakness is responsible for such occurrences.

Continuous Seismic Profile—a New Far North Exploration Tool 132

By A. E. Pallister

A new approach to seismic exploration in lakes and rivers of the Canadian North involves a repeatable sound source towed behind a boat. Sound waves are picked up and transmitted to a compact recorder. The crew boasts of only three men, which can cover 40 miles of profile a day.

Well Servicing in Canada Poses Special Problems 136

By C. R. Olson and L. H. Stewart

The problems of service companies in Canada differ greatly from those in the United States. Both operational and technical differences arise. Chief factors are climate, distance, and road problems.

Canadian Explorers Ponder New Province—Central British Columbia 142

By Hans P. Trettin

Here's a preliminary look at the stratigraphy and structure of South Central British Columbia, the site of some current exploratory drilling. Surface reconnaissance in the area reveals the presence of source and reservoir rocks. But the chances of successful oil exploration are believed to be slim.

Helicopter Geology Is Faster, Cheaper When the Going is Tough 150

By Jack A. Walper

The helicopter has played a major role in unraveling the geology of the Yukon and the Northwest Territories. Surface geologists now can map, in one season, prospects that would require 5 or 10 years with old techniques.

New Light on Isopach Residue Values 153

By W. F. Stackler

The main problem in making gravitational data intelligible to geologists is finding methods to separate gravitational influences. A method is presented as an approach to solve the separation depending on depth of the various influences.

Canadian Gas-Processing Plant Will Be a Joint Effort of 26 Operators 160

British-American Oil Co., Ltd., has joined with 25 other companies to build processing facilities between Homeglen-Rimbey and Dick Lake fields in Alberta. The plant will have a capacity of 325 M.M.c.f.d. of raw gas.

TECHNOLOGY—OPERATION

Foam Removes Brine From Deep Texas Wells 162

By J. Eakin, A. D. Hopkins, and H. N. Dunning

Oil-Well Pumping—10: How To Find Power Requirements 164

By Joseph Zaba

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
August 15, 1960

Business is picking up in Washington again:

Now that Congress is back and most vacations are over, here are some key developments to watch for:

Interior will announce fourth-quarter residual fuel import quotas this week. This no doubt will create an uproar in some circles and may prompt an effort to get congressional action.

An effort to cut oil's percentage depletion may pop up on the Senate floor at any time. One reason: To embarrass Kennedy and Johnson, who have voted on opposite sides of the issue in the past. However, there isn't likely to be any real steam behind the drive because the issue cuts sharply across party lines.

The Federal Power Commission, which already has turned loose a flurry of decisions recently, has more coming, including the long-awaited Phillips case.

▼ ▼ ▼

Crude prices are top news again following Esso's move to cut its postings for all Middle East crude (p. 83)*.

Only about 10% of the Middle East production is involved. But both the Arab producing countries and Venezuela reacted quickly in an effort to head off spread of the cuts.

Esso says heavy volume of sales at discounts had made the old postings unrealistic. In effect, the move made the producing countries share the cost of discount sales. The recent Russian crude offers also were a minor factor.

Possible effects on domestic U. S. crude prices still have not been determined. Domestic markets have firmed up substantially in past weeks due to production restrictions and heavy refinery runs (See Market Memo).

▼ ▼ ▼

Oil scouts have started fighting hard to save their profession from being replaced by commercial information services. Their target: The minds of company management.

They have enlisted heavy management support too in a few areas. The scouts argue they can give management a much bet-

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*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

ter service which will be less expensive in the long run than that offered by commercial outfits.

Some operators, the scouts claim, already are disenchanted with some of the services and are rejoining the old scout checks (p. 92).

Exploration notes:

Drilling activity is humming along Cardium Alley, the narrow strip hugging the Cremona Oil Pipeline for 30 miles from Calgary northwest to Carstairs. Eleven rigs are busy now either drilling for the Cardium or testing that pay on the way down to the area's prolific gas zone in the Mississipian (p. 195).

Humble is drilling its important Oregon wildcat in Lake County. It's located on a huge surface anticline and is the first of a reported 3-well drilling program aimed at pre-Tertiary strata in South Central Oregon (p. 202).

Development drilling in the Rocky Mountain region is off this year and accounts for the 280-well lag in completions for the region. One big factor in the slowdown has been wider spacing resulting from operators' drive to cut costs.

The Los Angeles town-lot drilling play has been jolted by three dry holes at California Standard, Mobil, and Humble wells. Conoco still plans to drill a fourth well on an 800-acre lease covering MGM and Desilu TV lots (p. 105).

East Texas wildcatters are stepping up their hunt for potentially rich but elusive production in deep Jurassic pay. Two new fields were opened last week—one in Cass County and the other in Hunt County. Ten wildcats and at least two field wells are currently drilling for the horizon (p. 98).

▼ ▼ ▼

Compact cars are a boon to multigrade pumps.

That's the opinion of one marketer who notes that the compacts don't always perform well on regular, but they don't need all the octanes in premium. Thus, compact car owners who want performance and economy are good prospects for the several grades furnished by custom blending.

Signal Oil & Gas is on the move again in marketing.

The company will introduce its multigrade marketing to Los Angeles this week and has plans to change its brand name on the Gulf Coast.

Signal is offering seven grades of gasoline to Los Angeles customers, and competition has an eye on any success the program may enjoy.

On the Gulf Coast, Signal is changing its "Starfire" brand to "Hancock," the brand name used in Los Angeles. And there are reports the brand-name switch is a prelude to introducing multigrade marketing in Texas and Louisiana.

Marketers have mixed reactions to Indiana Standard's

move into accident insurance sales at service stations.

Comments range from "too bad we didn't think of it first" to "It won't sell any gasoline." But everybody is watching the experiment closely.

▼ ▼ ▼

Look for Canadian crude to crack some new Great Lakes area markets in the U. S. the last half of this year.

Three refineries not now using Canadian crude are expected to start soon.

Demand for kerosene-type jet fuel has grown so sharply that major suppliers are unable to supply the market.

This situation has opened the door to smaller refiners who are now in position to pick up some commercial airline business either directly or through major companies caught short of products to meet their customers' needs.

OCAW expects wage talks in the oil industry to pick up speed in the next few weeks. Union officials expect to have ratification this week of proposed bargaining program for 18-cent hourly wage increases.

National bargaining policy committee adopted the program in June. It must also be approved by three-fourths of OCAW locals before it becomes mandatory for all locals. A secret ballot also is being taken to authorize the international to call strikes to back up the demands.

▼ ▼ ▼

Canadian gas imports have cleared another hurdle.

FPC has approved the movement into the Pacific Northwest and California. Now only approval of California authorities is needed. Canada's consent was given earlier.

Should the California decision be delayed much longer, construction on the necessary pipelines may be held up until spring (p. 102).

Other pipeline news: Deal is brewing involving sale of Gulf's deep-water terminal at Mobile and pipeline system into southeastern Mississippi to Hess Trading & Transport Co. (p. 86)...Far-reaching implications are being read into plans for the Texas-Mexico gas line to California. It would affect pipelines serving both coasts and gas development in Texas, Louisiana, and Mexico (p. 96)....Transwestern gas line to California has started up after FPC approved a 6¼% rate of return and 42 cents per M.c.f. for the gas.

Interesting stock-market note: Phillips Petroleum Co. has acquired 37,500 more shares of Union Oil Co. of California common. The purchase runs Phillips' holdings in Union to 1,196,400 shares.

Market Memo

August 15, 1960

The industry missed its chance during July to improve the supply-demand picture of major products.

Demand turned in an exceptional performance.

But supplies kept on growing when refiners elected to continue excessive crude runs to stills.

These high crude runs are giving a fictitious show of strength to crude oil—not warranted by demand. Market is tight now for September shipment.

With Labor Day, the traditional point of diminishing demand, just around the corner, the addition to gasoline inventory last week merely adds to the wrong-way trend.

This confused outlook plus foreign crude price cuts will make this week's Texas Railroad Commission hearing interesting. Majority of buyers in Texas are asking for allowables pegged on 9 producing days.

Phillips is asking for 8 days, Humble for 10, and all others for 9.

Commission Chairman Ernest O. Thompson has asked for a breakdown of product stocks from all nominating companies. His questions could prove embarrassing for the major refiners to answer.

Group 3 gasoline for northern shipment has advanced one-half cent per gallon. Posting for 91-RON gasoline is now 12.5 cents and for 99-RON 15.25 cents.

Middle distillates in Group 3 are closely held for better prices. Recent volume purchase of No. 2 by a major added strength to present 8.5-cent posted price. No. 1 is posted at 9.5 cents and fairly active.

Chicago gasoline prices are lagging as compared with Group 3, with 91-RON firm at 12.5 cents. Inquiries are being made for distillates which are firm at 9.75 for No. 1 and 9 cents for No. 2.

River markets are quiet on all products. Inventories are in good shape along the river, and no distress offerings are in evidence. Gasoline ranges from low Gulf Coast of 11.25 cents for 92 RON down to one-quarter cent off that price depending on f.o.b. point. No. 1 and No. 2 are inactive.

Gulf Coast posted prices are firm for all products. With only a limited number of August cargoes available in the coast, 92-RON gasoline is firm at 11.25 cents...No. 2 also is firm at 8.25 cents per gallon and is in excellent inventory position to advance...No. 6 is tight at $2.35 per barrel and $2.55 for low-sulfur product.

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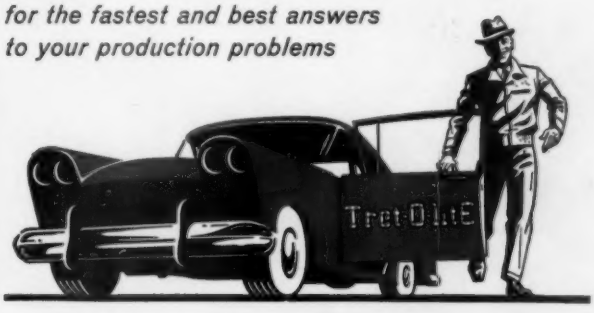

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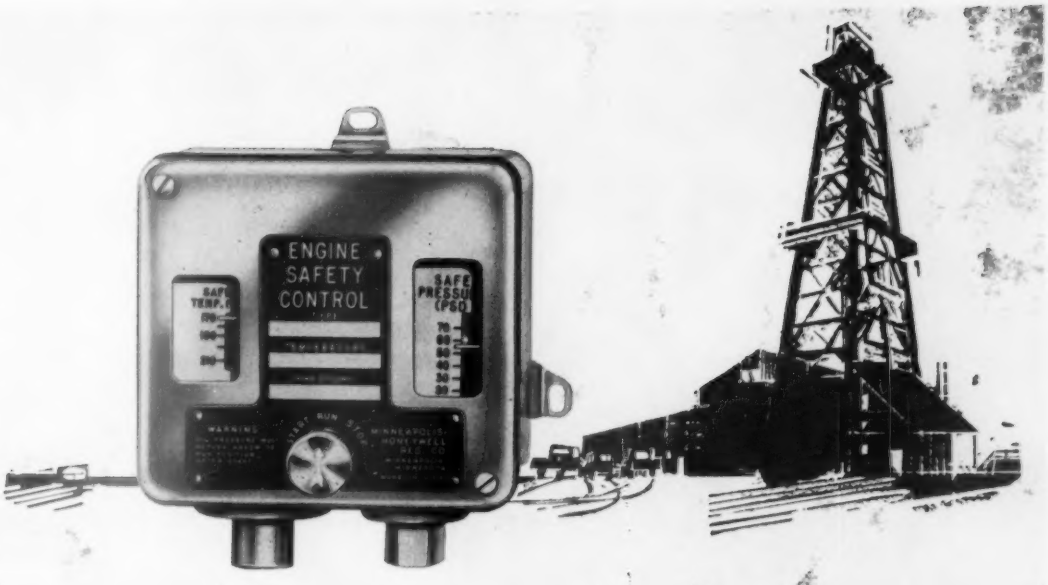

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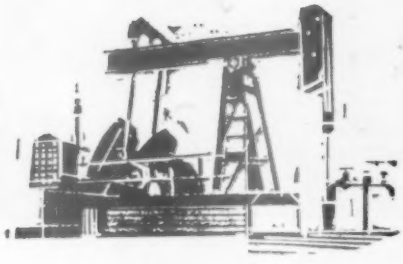

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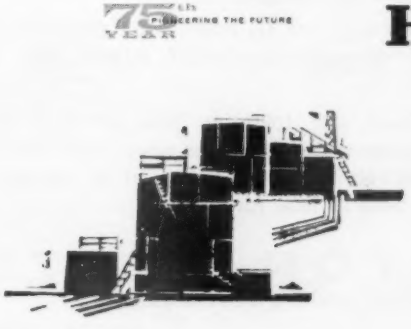

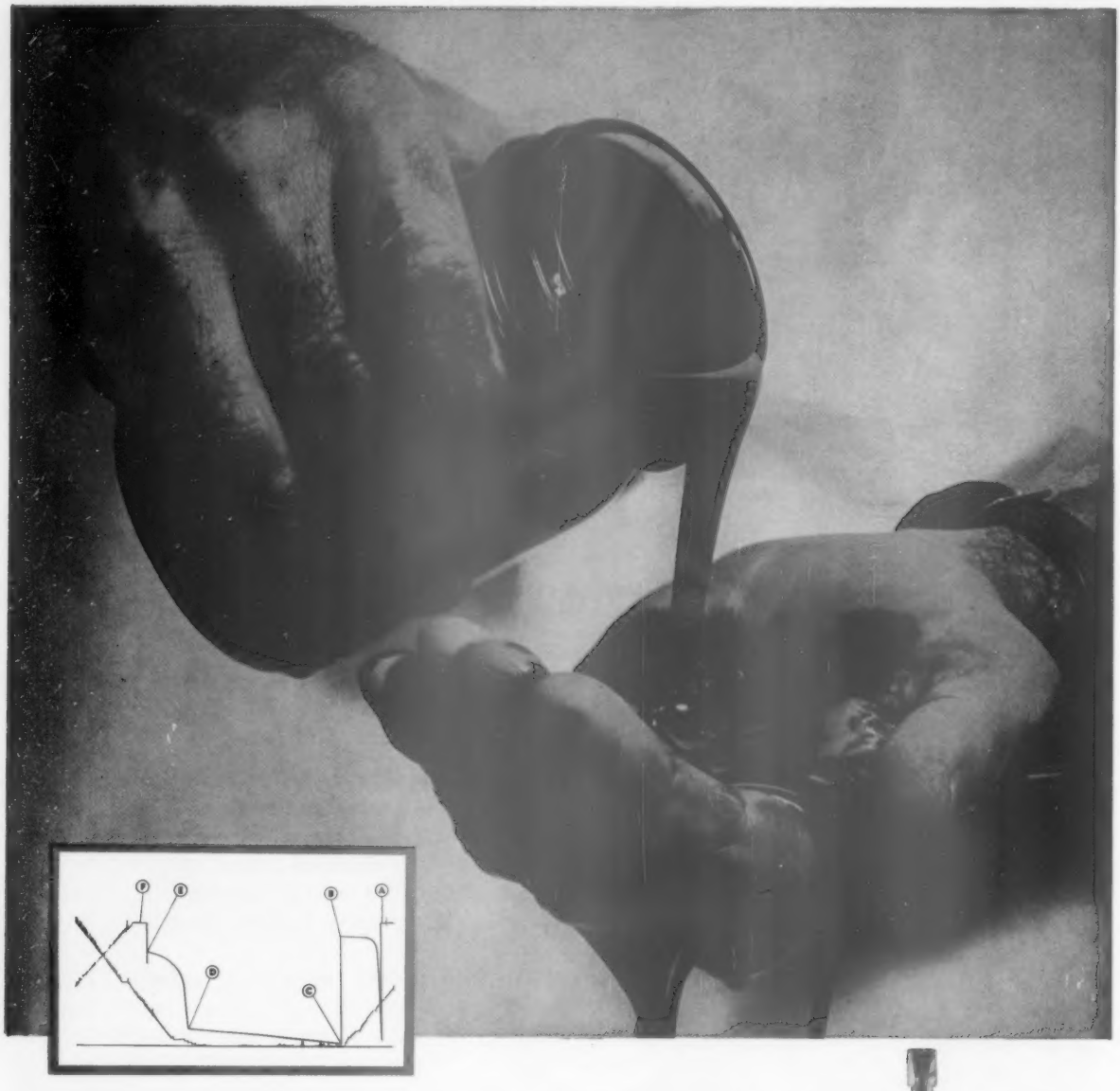

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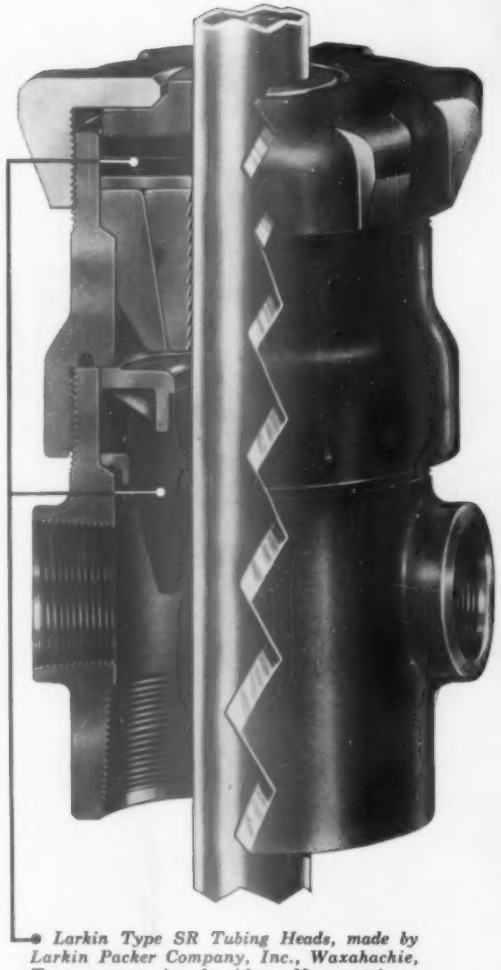

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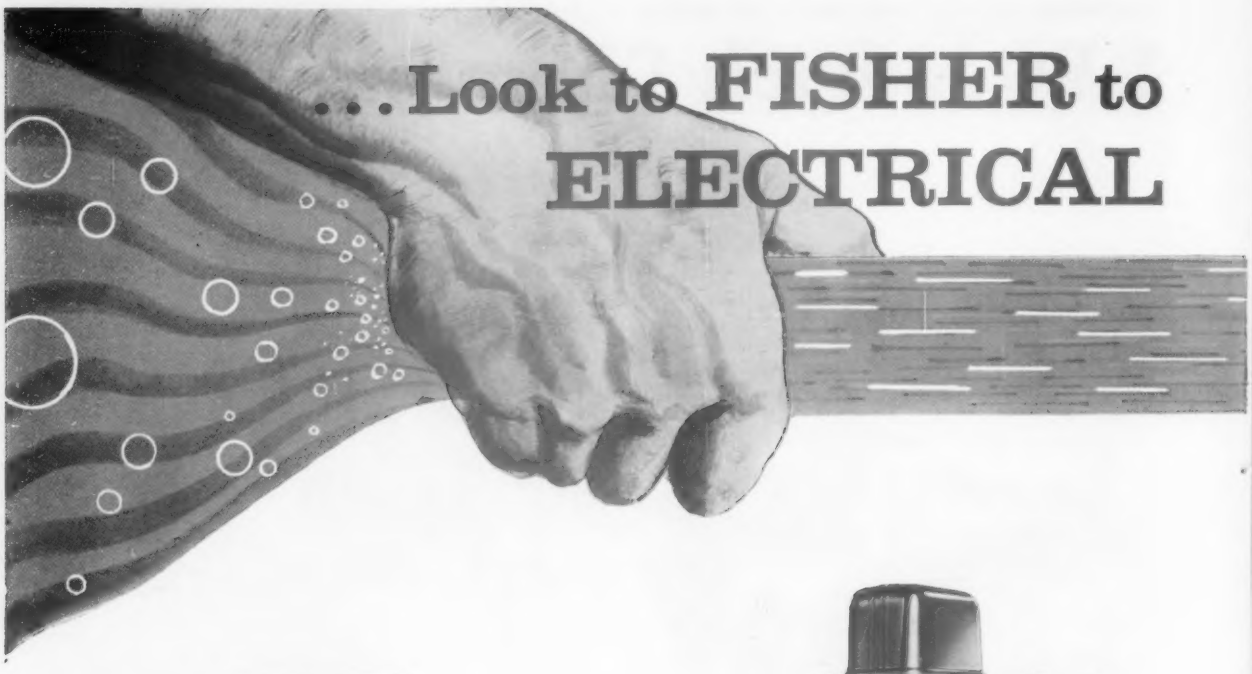

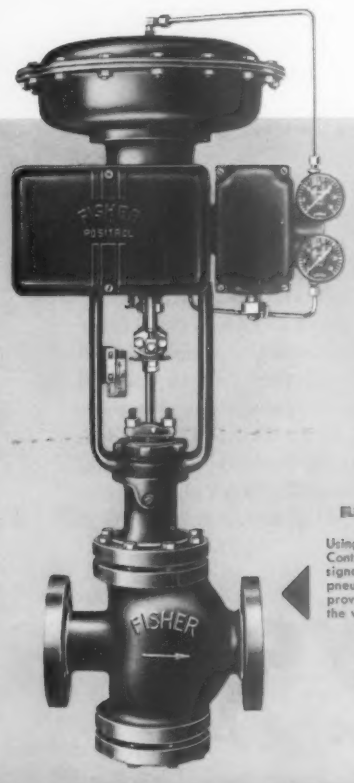

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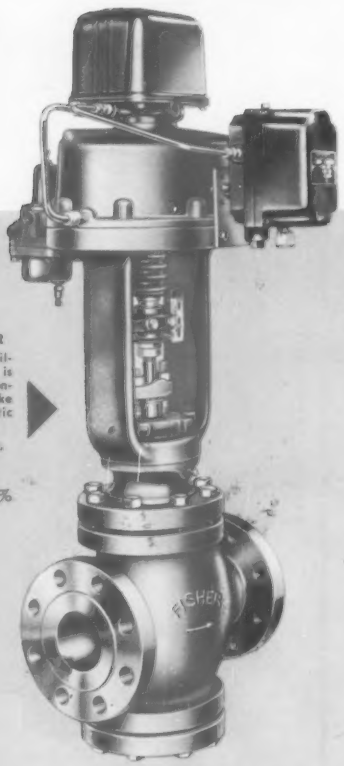
Linearity—1% of Full Range

Resolution Sensitivity—Less than 0.1% of Input Range.



THE ELECTRO-PNEUMATIC POSITIONER "E-POSITROL"

Using a conventional Fisher diaphragm Control Valve, the E-Positrol receives a Ma signal and translates this to a proportional pneumatic signal to a positioner which provides the speed and power to operate the valve.

Input Current: 1-5 ma; 4 to 20 ma, 10 to 50 ma D.C.

Linearity—1% of full scale.

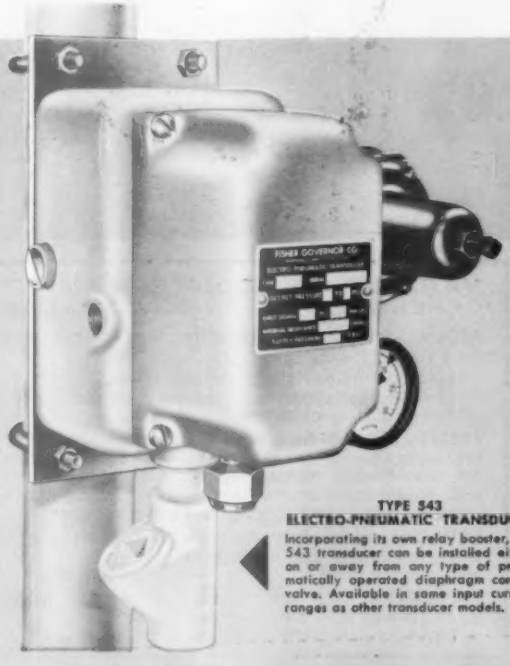
Resolution Sensitivity—0.1% of input range.

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD... CHANCES ARE IT'S CONTROLLED BY...

supply the muscles for your CONTROL SYSTEMS

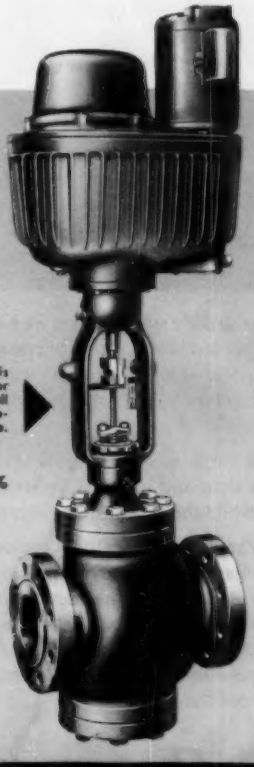
The old adage, "a chain is as strong as its weakest link" can be equally applied to the "muscle" or more correctly the final control element on any control loop. The importance of a control valve in an electronic system should never be considered lightly and that is why you should look to Fisher for assurance in furnishing dependable and accurate control valves for your electrical or electronic system.

Described below are three types of actuators that offer an exceptionally practical and economical approach for control valves in electrical control loops.



TYPE 543
ELECTRO-PNEUMATIC TRANSDUCER

Incorporating its own relay booster, the 543 transducer can be installed either on or away from any type of pneumatically operated diaphragm control valve. Available in same input current ranges as other transducer models.



THE TYPE 350
ELECTRO-HYDRAULIC ACTUATOR

In electrical control systems where air is not available or desirable, the Fisher Electro-Hydraulic Actuator provides all the necessary requirements for a dependable and accurate control valve.

Maximum Stem Thrust..2000 pounds
Stroking Speed.....0.37 in./sec.
Resolution Sensitivity...less than 0.05%

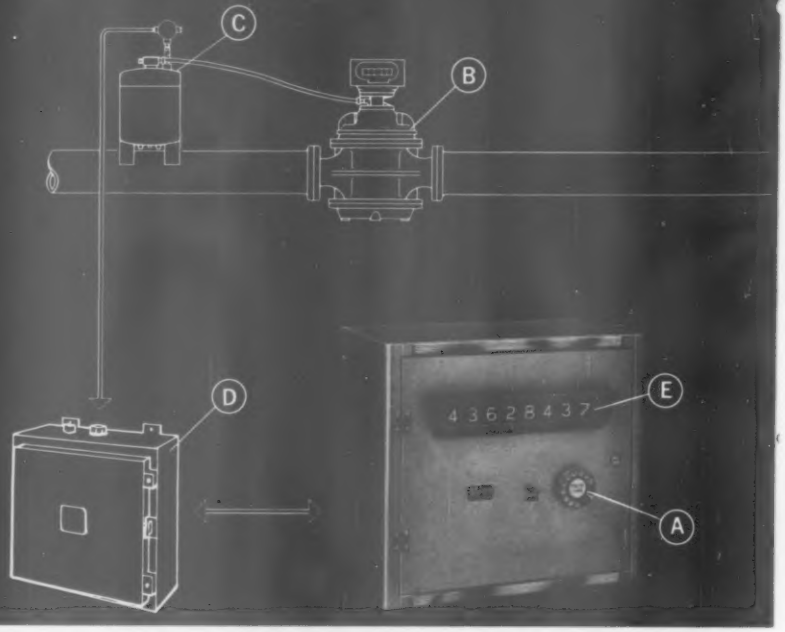
FISHER® Controls
SINCE 1880

FISHER GOVERNOR COMPANY
Marshalltown, Iowa / Woodstock, Ontario / London, England
BUTTERFLY VALVE DIVISION: CONTINENTAL EQUIPMENT CO., CORAOPOLIS, PA.

VAREC PULSE CODE

A NEW ECONOMICAL AND RELIABLE SYSTEM FOR REMOTE READING OF P. D. METERS IN PETROLEUM PIPELINES

A Varec telemetering cycle takes just 7 seconds . . . starts when the operator uses a dial **(A)** to contact a selection point. The P. D. meter **(B)** responds, through mechanical coupling or electrical inpulse, through a transmitter **(C)** which transmits the data to a remote selector **(D)**. The selector provides for multipoint selection from widely scattered points . . . sends the data to the receiver **(E)** where it is decoded and displayed in digital form.



Varec's pulse code system, used with P. D. Meters, provides highly accurate,' centralized telemetering across any distance . . . offers important user economy with a simple communications link of either a two-way physical line or carrier-derived channel.

The Pulse Code is a true digital system . . . transmits data rapidly in dots and dashes . . . provides 'error-proof' reading even while the P. D. Meter is running.

Typical Varec system features include: the code is established by Varec transmitters which are available in models for either electrical or mechanical input . . . selectors with 10 to 100 selection capacities . . . high capacity receivers with 99 identification numbers and 6 digits of data (up to one million counts . . . and illuminated, "in-line" display receiver readings.

VAREC PULSE CODE EQUIPMENT OFFERS ALL THESE ADVANTAGES

ACCURACY: Provides one point in one million accuracy for a six digit unit.

RELIABILITY: Consists of simple, compact electro-mechanical components . . . needs no vacuum tubes or other complex electronic equipment.

FLEXIBILITY: Designed on a building block principle that permits unlimited variety of system arrangements for telemetering measurements of any transducers with an electrical or mechanical output . . . or adding remote control, data logging and alarm systems.

ECONOMY: Requires much lower wire count . . . only a single communications channel—between receiver and gauging point.

EXPERIENCE: Offered by Varec . . . pioneers in the remote gauging field with over six years field experience in liquid level and temperature telemetering.

For more information on the Varec Pulse Code/P. D. Meter System, write for Varec Bulletin CP-3701, Dept. OGJ-1223-1.

"Varec"
TRADE ® MARK

THE VAPOR RECOVERY SYSTEMS COMPANY
2820 North Alameda Street • Compton, California
Branches and Representatives in Principal Cities

Mid-Continent's Chain of EQUIPMENT SUPERMARKETS

SWAN HILLS ★

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RED DEER ★

★ ESTEVAN

GEARED TO THE NEEDS OF CANADA'S FAST-GROWING PETROLEUM INDUSTRY

Wherever there is oil in Canada, there is a Mid-Continent supply store stocked with thousands of items to meet your field requirements — virtually an oil field supermarket. A mobile store in the Swan Hills area, with a direct teletype system to Edmonton, is the latest addition to this chain. Throughout the oil field, look for Mid-Continent's neon derrick where you will find sure service . . . sure supply around the clock.

DIVISION OFFICE:
Calgary, Alberta

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SMI-O

MID-CONTINENT – SUPERMARKET FOR THE OIL INDUSTRY

MID-CONTINENT SUPPLY CO.

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

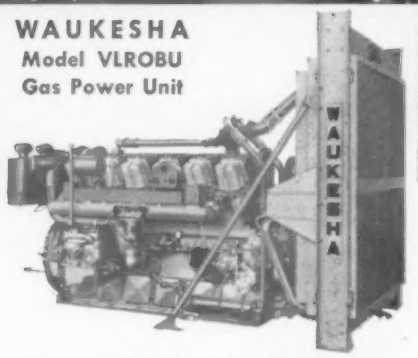
Mid-Continent Building, Fort Worth, Texas • Export Division: 45 Rockefeller Plaza, New York 20, N.Y. Cable: MIDCUMPORT NYK

three WAUKESHAS power

B. L. McFarland Drilling Co., of Midland, Texas, first to drill with new "1500" Gardner-Denver rig.

With its drawworks rated 1500 input hp, this new Gardner-Denver "1500" rig is fast, economical and efficient for drilling to 20,000-ft. with 4½-in. O.D. drill pipe. A total of 8 forward and 2 reverse speeds to the drum; 4 forward and 2 reverse speeds to the rotary table can be obtained. Compounds and drive arrangements for this drawworks are limited only by customer requirements. The McFarland rig shown includes a 142-ft. 1-million lb. capacity drilling mast, one Gardner-Denver RT-27½ rotary table, and two Gardner-Denver GR-GXR mud pumps. Powering the rig are three Waukesha Model VLROBU Waukesha Gas Power Units with tremendously powerful, rugged 12-cylinder 5788 cu. in. engines, each developing 700 continuous duty hp, well known for their long-life dependability and economy in oil field service.

WAUKESHA
Model VLROBU
Gas Power Unit



Big powerful 12-cylinder high compression, overhead valve, 60-degree vee, four-cycle engine of 8½-in. bore and stroke, 5788 cu. in. displacement. Connecting rods are paired; opposing pistons operating from a single wide area 5¾-in. dia. crankpin; 7-bearing 6¼-in. dia. crankshaft. Send for Bulletin 1656.

Waukesha Engines and Power Units to 1235 hp. Turbocharged and Normal Diesels, Natural Gas, LPG. Get Bulletin 1079.

SEE OUR CATALOG IN COMPOSITE CATALOG

491

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN / **New York • Tulsa • Los Angeles**
Factories: Waukesha, Wisconsin and Clinton, Iowa

"I go for one-stop shopping"

Baash-Ross and Web Wilson Tools
are sold only thru supply stores

EXTENSIVE RENTAL AND SERVICE FACILITIES ARE AVAILABLE
IN MOST OIL FIELD AREAS . . . CALL US

BAASH ROSS DIV JOY

OUR 41ST YEAR OF PROGRESS

BAASH-ROSS

DIVISION OF JOY MANUFACTURING CO.

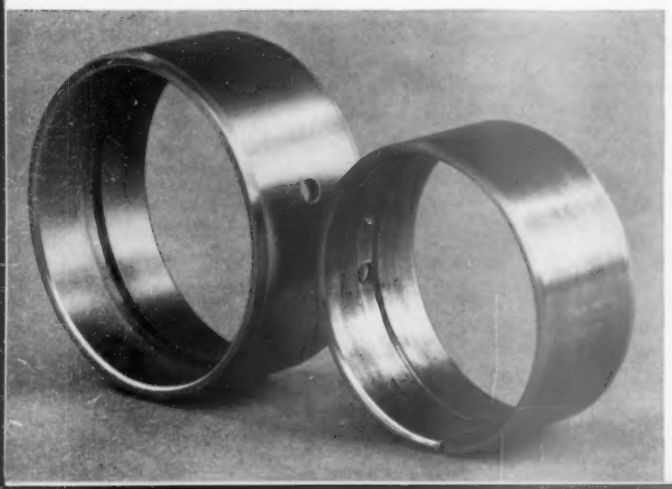
General Offices: Houston, Texas

Before it is shipped every

run-in and tested

Part of Onan's testing facilities—largest electric generating plant testing area in the industry!

Big, brawny bearings on Onan engines—twice the bearing area of most competitive bearings. Means longer life between overhauls. Another of many ways that Onan is built *up* to performance, not built down to a price.



Stellite coated exhaust valves and valve seats. One of toughest alloys known. Gives you up to 300% longer valve life than uncoated valves. It's the important details like this that make Onan more economical in the long run.

Onan Electric Plant is for hours

And we mean every Onan Electric Plant! This rugged workout under load means every Onan is ready for hard work the day you get it!

Every Onan plant has a nameplate with horsepower and output ratings. Every single plant is put through a series of tough tests to make sure it does what the nameplate says it will do *before it is crated for shipping.*

But this isn't enough. Inspectors from an independent laboratory pay our factory frequent surprise visits. Their job is to check and double-check—our tested plants as well as our testing equipment and methods. They pull a plant off the line, run it, stop it, gun it, stall it, check and recheck. The end result is Onan's exclusive *Performance Certification* . . . your guarantee of getting the power you paid for.

See the dependable Onan Generating Power Plants soon. You can find an Onan distributor in the Yellow Pages in every major city, or write direct.

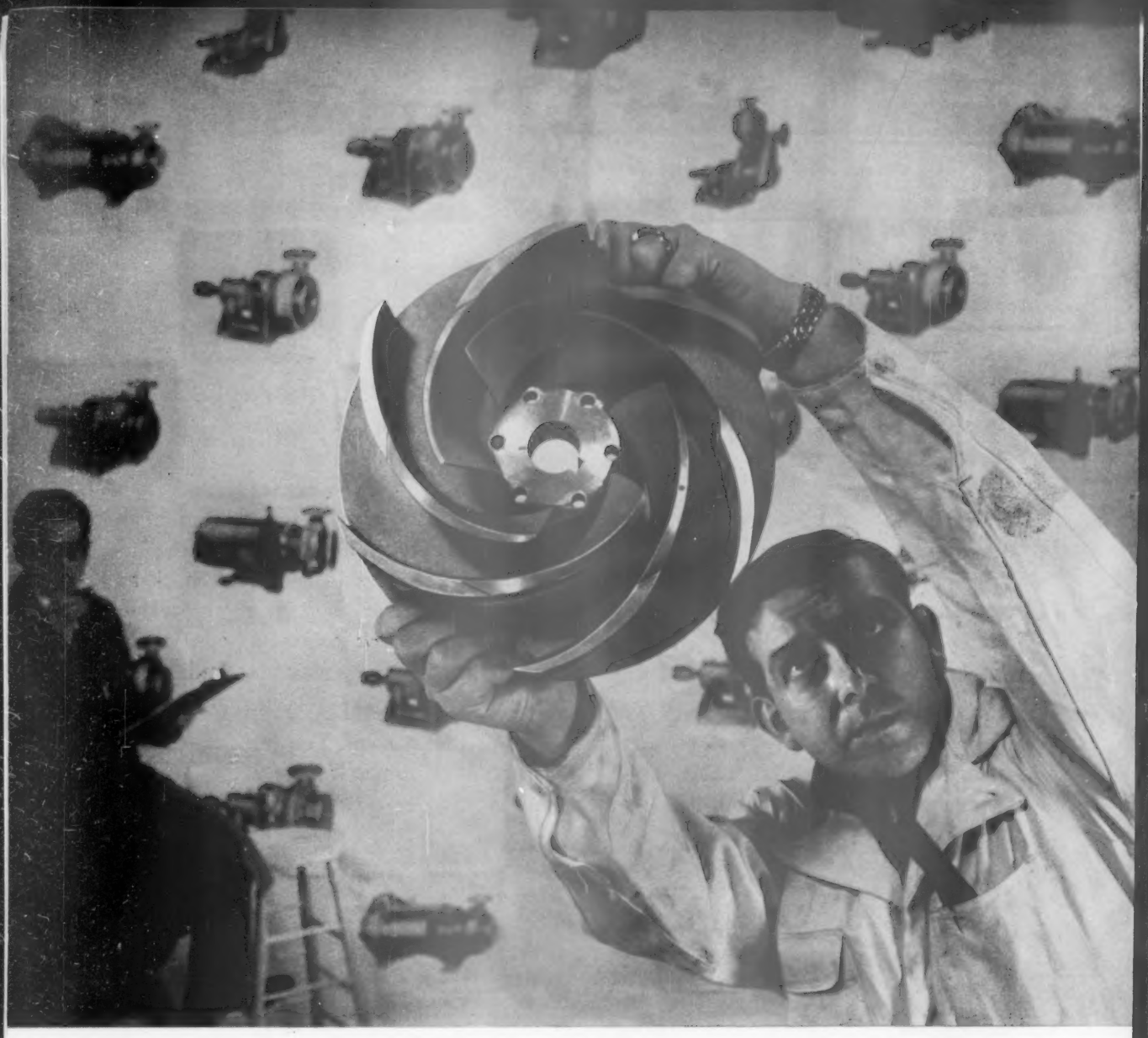
ONLY ONAN GIVES YOU THIS CERTIFICATION

PERFORMANCE CERTIFIED
We certify that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.
D. W. ONAN & SONS INC.
Minneapolis 14, Minnesota
Onan

Onan®

World's Leading Builder of Electric Power Plants

D. W. ONAN & SONS INC., 2628 UNIVERSITY AVE. S.E., MINNEAPOLIS 14, MINN.



PICK YOUR IMPELLER, PICK YOUR PUMP

Of course, you never bought an impeller and then bought the pump later. But 'pick your impeller, pick your pump' is one way of suggesting you put *performance* before *standardization*.

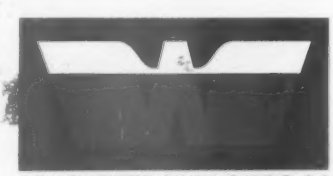
Sure, we can give you pumps from a complete standardized line. We can, for example, show you how four basic frames are used in six different pump types and 127 different models. And we can show you one bearing that spins in 51 different sizes, or one shaft that turns in 39 sizes. So far as we know, there's no more standardized line of centrifugal pumps than this.

But we can't help reminding you that the day-to-day economy of any pump lies in its operating efficiency plus how close it comes to meeting your exact performance requirements. Only after these conditions are met does a minimum number of parts lying in your storeroom really count.

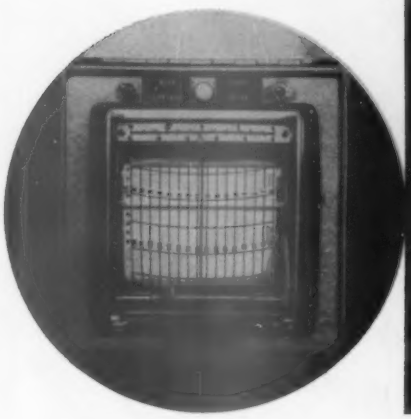
So, to you it's most important that this line of Worthington SESC pumps contains more (not less) different types of impellers than any other line. It contains open, closed and semi-open impellers. Each is available in five different materials to handle abrasive or corrosive materials, water or slurries. In fact, because of the extensive impeller selection, this line offers a 'customerized' pump selection meeting more specific performance requirements than any other line.

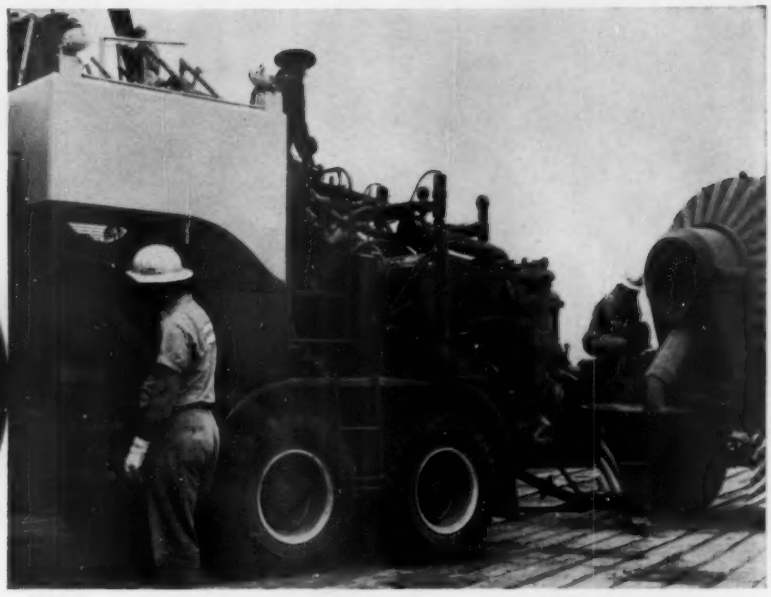
But don't take our word for it. Take a look at the SESC pump line. You'll see it's standardized to the nth degree in ratings up to 3000 gpm and 550 ft. heads. But there are more impellers to choose from . . . thus you can buy a custom built pump at standard prices.

For the name of your nearest Worthington distributor consult the Yellow Pages or write Worthington Corporation, Section 20-18, Harrison, New Jersey.



WORTHINGTON





ONLY HALLIBURTON CEMENTING RESEARCH COULD DEVELOP THE NEW DENSITROLLER

Automatically controlled slurry density during a cementing job *assures* the customer that the pre-selected slurry weight will be maintained accurately throughout the entire cementing job with the new Halliburton Densitroller. Once the cementing operation begins, Halliburton's Densometer sends a slurry density signal to the Densitroller which acts to control fluid input, maintaining the preset slurry weight. Accuracy in this completely automated system of ±0.1 pound per gallon can be maintained.

■ ANOTHER NEW DEVELOPMENT: *THE HALLIBURTON FLOWMETER*

A unique new device, the Halliburton Flowmeter gives accurate measurements of total slurry displaced during the entire cementing job as well as indicating the flow rate. With this instrument the positions of the cementing plugs can be easily determined at any time during the operation, and the cement position can be checked during plug back or squeeze operations. It is also valuable in helping to maintain equal displacement during multiple string completions.

Through research Halliburton will continue to provide you with progressive developments. Just as the two cementing pump method has been a Halliburton standard for over 35 years, today's new developments will be standards of the future.

HALLIBURTON
CEMENTING SERVICES
HALLIBURTON COMPANY — DUNCAN, OKLAHOMA

Continuous Progress through Continuous Research

. . . . . What's the limit: Heat? Shock? Speed? Or complicated radial and thrust loads?

Name the combination of requirements . . . and chances are you'll find them met by a Rollway Maximum precision radial cylindrical roller bearing. If not, then Rollway engineers will modify any factor to meet your application.

Rollers are crowned to prevent end-loading and the resultant spalling of races. Directional trueness is maintained by retainers of standard bronze or "Rollube" ferrous alloy of one piece or two piece construction.

You may wish to refer to the Rollway Catalog and Engineering Data Book when writing specifications for a high precision bearing. It contains the first listing, by any manufacturer, of the thrust capacities of cylindrical radial roller bearings. Send for it today.

ENGINEERING OFFICES:

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Toronto Pittsburgh Cleveland
Seattle Houston Philadelphia
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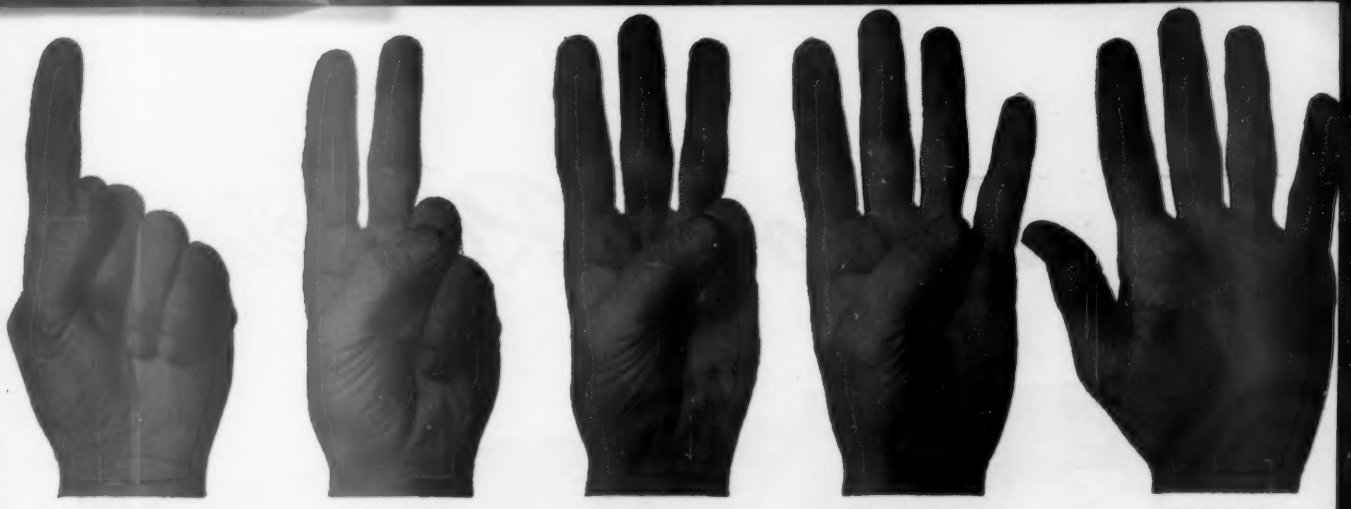
ROLLWAY®
BEARINGS
COMPLETE LINE OF RADIAL AND THRUST CYLINDRICAL ROLLER BEARINGS



BETTER drilling rates in all types of muds: T-8, lime, gyp, and low pH, with varying amounts of oil.

BETTER (lower) barite requirements when substituted for oil in muds.

BETTER hole lubrication, in all types of muds, to reduce pipe sticking.

BETTER bit bearing life **even in high solids muds.**

BETTER geological interpretation and electrical logs; no fluorescence.

PLAN WITH BIT LUBE to drill 5 ways better . . .

MAGCOBAR PLANNED MUD PROGRAMS make the above statements facts, not claims. In high weight emulsion muds, for example, the Magcobar engineer properly substitutes Bit Lube® for some of the oil to cut drilling costs by reducing the amount of barite required. In a typical well, the oil content of the mud was allowed to drop from 11 to 5 per cent. Bit Lube was added to this 17.8 lb./gal. lime mud with these savings in barite:

	Sacks of barite per day	Cost of barite per day	Cost of Bit Lube per day	Cost of Oil per day	Total Cost per day
Emulsion (2 week average)	177	$409.76	$—0—	$74.03	$483.79
Bit Lube and Emulsion (3 week average)	52	120.38	122.43	8.25	251.06

NET DAILY SAVINGS WITH BIT LUBE: $232.73

Not only does Bit Lube give direct cost savings, but it also offers escape from costly pipe sticking, even in extreme directional holes. Bit Lube lowers the friction coefficient of the mud, to give over-all higher drilling mud performance. These savings can be added to those in the chart.

The skilled use of good products like Bit Lube to cut drilling costs is the heart of Magcobar Technology. Let the Magcobar engineer plan the mud program for your next well and this Technology will save for you all along the line.

Magcobar
Complete
DRILLING MUD SERVICE

DRESSER INDUSTRIES, INC.
OIL • GAS • CHEMICAL
ELECTRONIC • INDUSTRIAL

FRANKS *Explorer Rocket*

FRANKS *Explorer Cruiser*

OFTEN IMITATED . . . NEVER DUPLICATED

WORTH MORE WHEN YOU BUY 'EM
WORTH MORE WHEN YOU TRADE 'EM

Common sense will tell you that there **is** a difference in most things despite the tendency to imitate the leader. There's a difference in baseball players . . . in cooks . . . yes, even in oil well servicing units . . . although competitive units are getting to look mighty like the Franks Explorer.

Now, this **difference** is what keeps the Franks Explorer ahead of the pack. It's the difference which makes superintendents prefer Franks units on their jobs. It's the difference you feel in your pocketbook when you trade it in. The higher resale value of Franks Explorers speaks louder of this difference than any words we can dream up.

Ask the man who uses Franks!

Explorer FEATURES

- Full view control console
- Engineered weight distribution
- True capacity rated derricks, 100,000 to 275,000#
- Less downtime thru industrial engine economy, power and dependability
- High resale value as used equipment
- Field acceptance established

ON THE SPOT . . . 'ROUND THE CLOCK . . . FIELD SERVICE

WELL SERVICING AND DRILLING UNITS

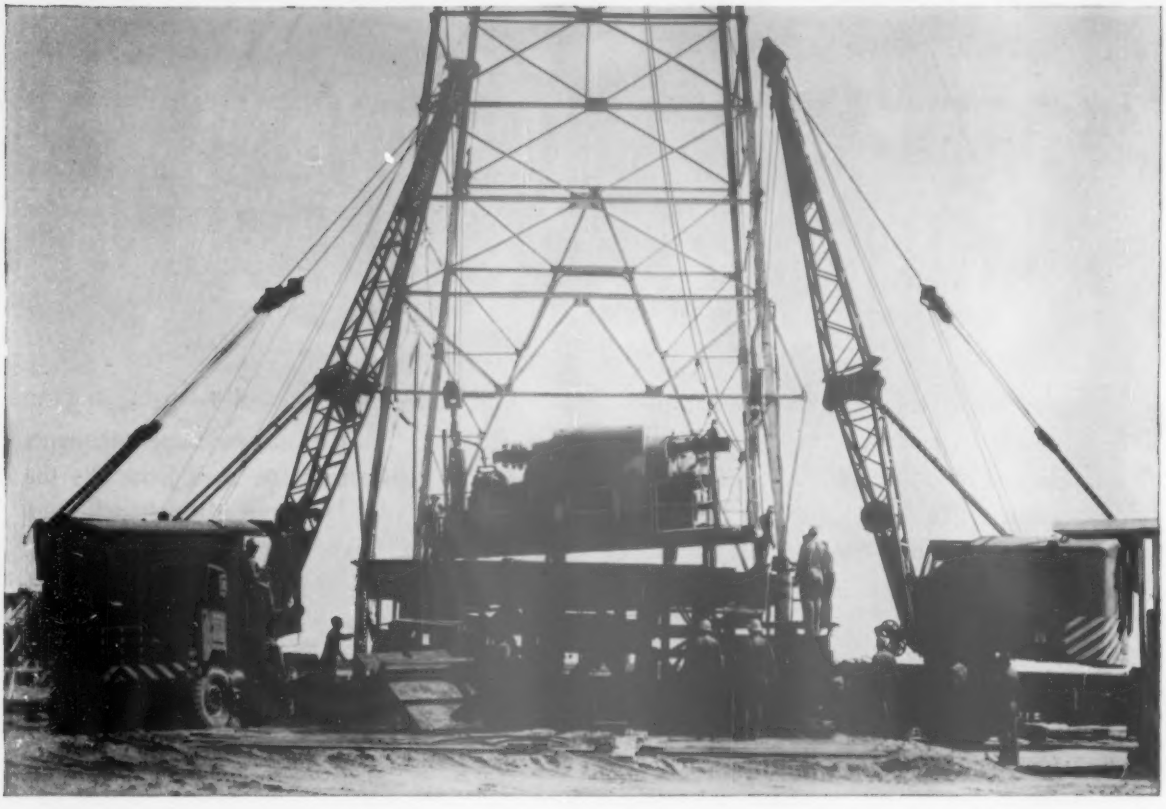
FRANKS

DIVISION OF

CABOT

PAMPA, TEXAS

OFTEN IMITATED . . . NEVER DUPLICATED



Geared by Fuller . . . Handling rigging operations for the Llano Drilling Company, on a well near Odessa, Texas, are two Northwest Truck Cranes owned by Odessa contractors Clyde Yarbrough, Inc., and J. H. Marks Trucking Co. (Information courtesy Drill Bit Magazine.)

6½-Hour Rigging Job with Fuller-geared Cranes

Six and a half hours from start to finish: that's the record of two Fuller-equipped Northwest Truck Cranes on a Texas oil well rigging job.

Handling the 78,000-pound drawworks and 16 tons of engines with ease, the 35-ton Northwest Cranes put the engine structure together, placed the drawworks and engines, and set the rotary table, traveling block and crown exactly where the crew wanted them . . . and did the whole job between 8:30 A.M. and 3:00 P.M.

Much of the credit for the agility of the 8 x 4 carriers, built by Hendrickson to Northwest specifications, goes to their rugged Fuller Transmissions. The 4-A-86 four-speed main transmission, in combination with a 2-A-92 two-speed auxiliary, provides a total of 8 forward and two reverse speeds for maximum performance under all working conditions. Fuller Transmissions have established an excellent record for availability, too . . . maintenance costs have been minimized and downtime for transmission repairs virtually eliminated.

Fuller Transmissions can help put more profit in *your* operation. For full details, see your truck or equipment dealer, or write Fuller Manufacturing Company.

FULLER

TRANSMISSION DIVISION
MANUFACTURING COMPANY
KALAMAZOO, MICHIGAN
Subsidiary EATON Manufacturing Company

Unit Drop Forge Div., Milwaukee 1, Wis. • Shuler Axle Co., Louisville, Ky. (Subsidiary) • Sales & Service, All Products, West. Dist. Branch, Oakland 6, Cal. and Southwest Dist. Office, Tulsa 3, Okla. Automotive Products Company, Ltd., Automotive House, Great Portland Street, London W.1, England, European Representative

Layne

SHORT COUPLED SERVICE PUMPS

for any job

TURBINE TYPE PUMPS
MIXED FLOW PUMPS
PROPELLER TYPE PUMPS
Capacities — 50 to 100,000 GPM
Heads — Up to 2,500 Ft.
Settings — As Specified
Discharge - Surface or underground

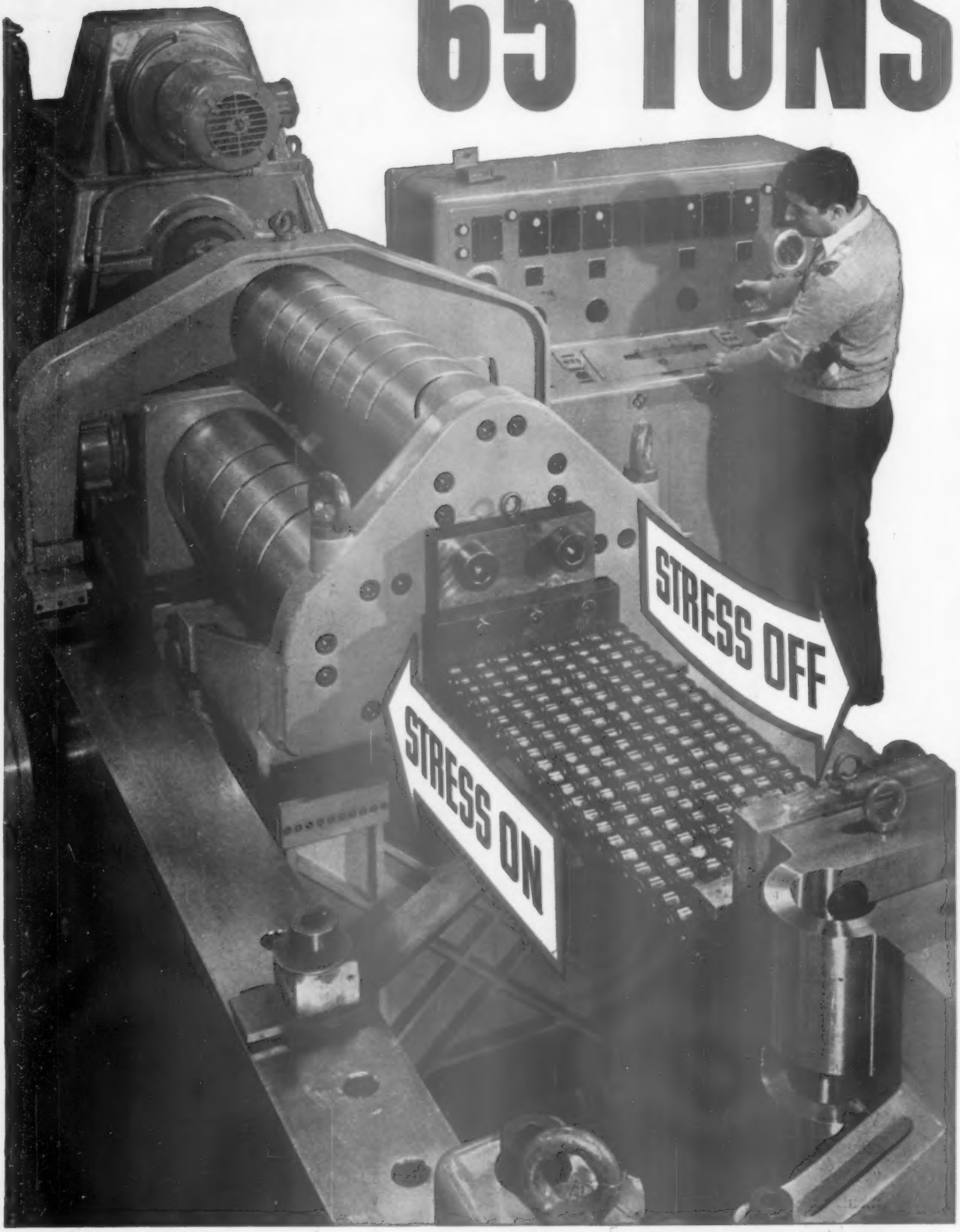
Top performance, high efficiency and less maintenance are factors which influence the selection of a short coupled pump. Layne Vertical Service Pumps fulfill these requirements and offer the advantages of lower installation and operation costs, low submergence requirements, simple alignment, no priming and less floor space demands. For any short coupled pumping job . . . specify Layne.

Write For Free Bulletins:
LAYNE TURBINE TYPE SERVICE PUMPS—NO. 300
LAYNE PROPELLER AND MIXED FLOW PUMPS—NO. 350

World's Largest Layne Water Developers

LAYNE & BOWLER, INC., MEMPHIS
General Offices and Factory, Memphis 8, Tenn.
LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD
SALES REPRESENTATIVES IN MAJOR CITIES

65 TONS



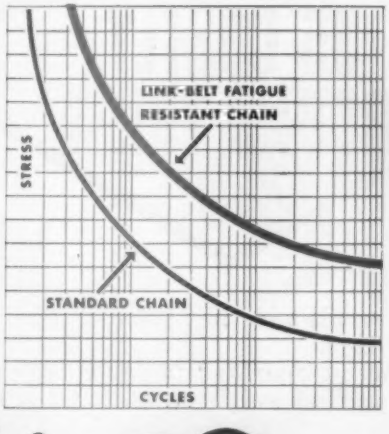
# of cyclic tension

Lab test proves the unexcelled fatigue strength of LINK-BELT roller chain with FR • FATIGUE RESISTANT

The equipment you see here — largest of its type known to be in operation in roller chain testing — enables Link-Belt to test and rate the largest-pitch, multiple-width chains used on today's drilling rigs. Its rapid "stress-on, stress-off" action duplicates the toughest conditions of rig operation at a greatly accelerated pace. It proves conclusively (see chart) the superior *fatigue resistance* imparted to roller chain by the FR process.

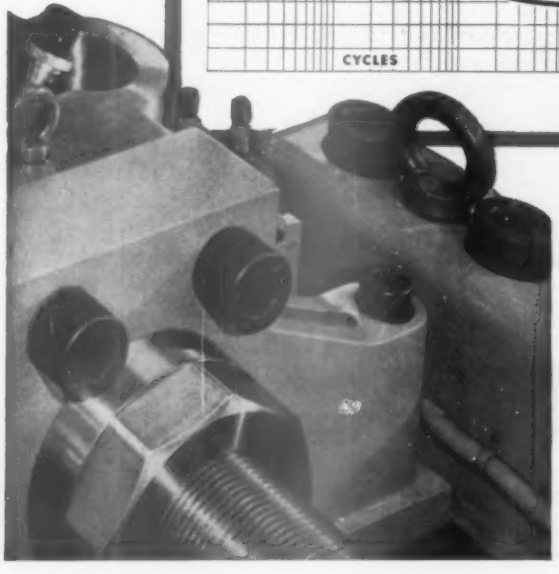
From such unequalled facilities for research comes roller chain unsurpassed in its ability to withstand the tremendous tensions of drilling service. In fact, Link-Belt can state without reservation: *No other roller chain has greater capacity to withstand the smashing impacts and tortuous stresses met in day-to-day drilling.*

FR and many other "extras" are standard with all Link-Belt oil field roller chains. Get full data in Catalog 1980, from any leading supply store.



U.S. Patent No. 2,517,497

This is FR. By compressing metal around pitch holes, Link-Belt greatly strengthens the critical sidebar areas most vulnerable to fatigue failure and greatly increases the chain's *dynamic strength.*

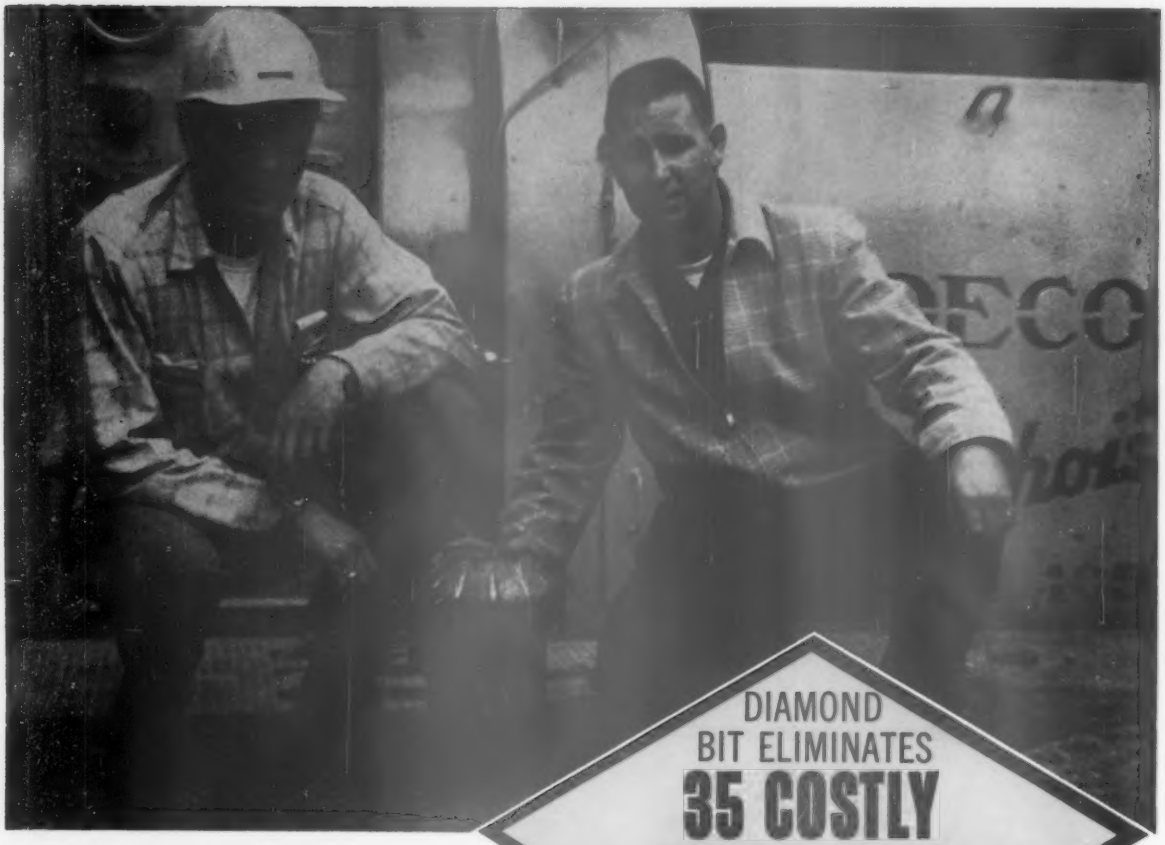


LINK-BELT

14,928

ROLLER CHAINS & SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 26, Odessa, Tex., New Orleans 16, Shreveport La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields.



DIAMOND
BIT ELIMINATES
35 COSTLY ROUND TRIPS

Christensen Diamond Drilling Bit sets endurance record of 28 rotating days on bottom

The new record was set by a major oil company using an 8-11/32″ Christensen diamond drilling bit in Natrona County, Wyoming. After 28 days rotating on bottom the bit was pulled at approximately 16,000 feet and found to be in fair condition. The operating company estimated that 35 round trips and 35 conventional bits would have been needed to drill the same intervals and that the diamond bit saved 18 days.

The bit operated under 10,000 to 16,000 pounds of weight at 53 to 57 R.P.M. The drill string consisted of 4-1/2″ drill pipe, nine 7″ collars with a set of jars. A second diamond bit had no trouble reaching bottom and ran for 16 rotating days, also surpassing the old 13 day record for the area.

For "Less Cost Per Foot" drilling, contact Christensen Diamond Products Company for information about its complete line of diamond bits and core barrels.

"Less cost per foot."

CHRISTENSEN DIAMOND PRODUCTS

MAIN OFFICE AND PLANT 1937 SOUTH 2nd WEST
P. O. BOX 387 SALT LAKE CITY, UTAH

EATON 2-SPEED TANDEMS

give you all the advantages of BOTH

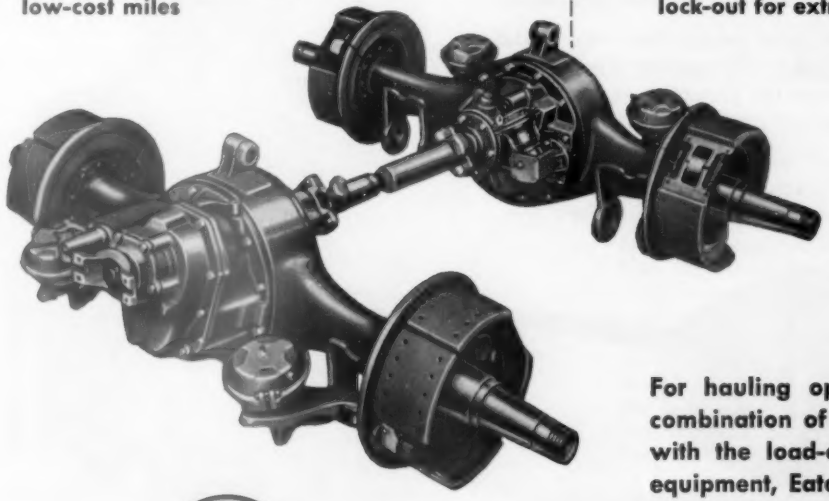
EATON 2-SPEED AXLES

- ★ *Double* the conventional number of available gear ratios
- ★ Power when you need it; speed when you want it
- ★ Engine operation within the most efficient, economical speed range
- ★ Low stress and wear on axle, clutch, transmission, and drive line
- ★ Simple, low-cost maintenance
- ★ Long truck life; thousands of extra low-cost miles

and

EATON TANDEM DRIVES

- ★ Short over-all length; maximum strength with minimum weight
- ★ Simplified design; few parts; easy, low-cost maintenance
- ★ Most parts interchangeable with standard Eaton 2-Speed Axles
- ★ No need to match tires; Eaton's inter-axle differential eliminates wheel-fight
- ★ Power equally transmitted to both axles
- ★ Driver-controlled inter-axle differential lock-out for extra traction when needed



Wide range of capacities. Eaton Tandems are also available in Single and Double Reduction types.

For hauling operations which require a combination of speed and power together with the load-carrying ability of tandem equipment, Eaton 2-Speed Tandems make big savings in hauling costs. Ask your truck dealer to tell you about the many exclusive profit-building features you get only in Eaton 2-Speed Tandems.

EATON

AXLE DIVISION

MANUFACTURING COMPANY

CLEVELAND 10, OHIO

It's Horse Sense . . . Why Chance Leaks in Seat Rings

Get Monel Seat BRONZE GATES made the way JENKINS makes them

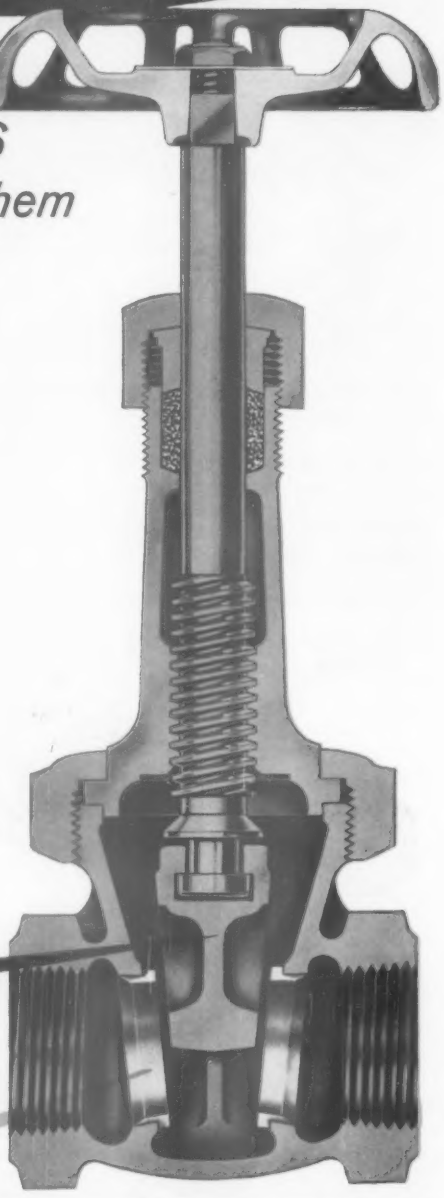
It's plain horse sense that you had better have the Monel seat rings EXPANDED (ROLLED) into the valve body if you want them to stay tight and leak-proof.

More horse sense . . . there's nothing valuable lost through having seat rings that can't be replaced by a regular maintenance man . . . **IF** the bronze or nickel alloy wedge has a lower degree of hardness than the heat-treated Monel seat rings. *(The way Jenkins makes them)* Then, the wedge takes the wear and seat rings are relatively unaffected.

Obviously, there's no faster, simpler or cheaper way to renew tightness and efficiency than to slip on a new wedge. And that, plus renewal of packing as needed, is all you need do to assure good performance from Jenkins Monel Seat Bronze Gates for as long as you'll need to care. Good service for scores of years is common.

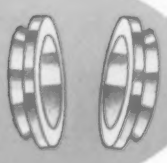
Long, low-cost life also results from greater-than-ever-needed strength in every part of these valves. The records of millions of Jenkins Bronze Gates show you get full protection against all the stresses encountered in use.

Your local Jenkins Distributor will quickly supply your needs from a wide variety of Jenkins Bronze Gates. For information about these valves, write for folder No. 181-C. Jenkins Bros., 100 Park Ave., New York 17.



WEDGE is less hard than seat rings. Wear affects this easily replaceable part . . . NOT seat rings

SEAT RINGS are expanded (rolled) into body. Permanent, all-around support is essential to prevent deforming, loosening, shifting, LEAKS

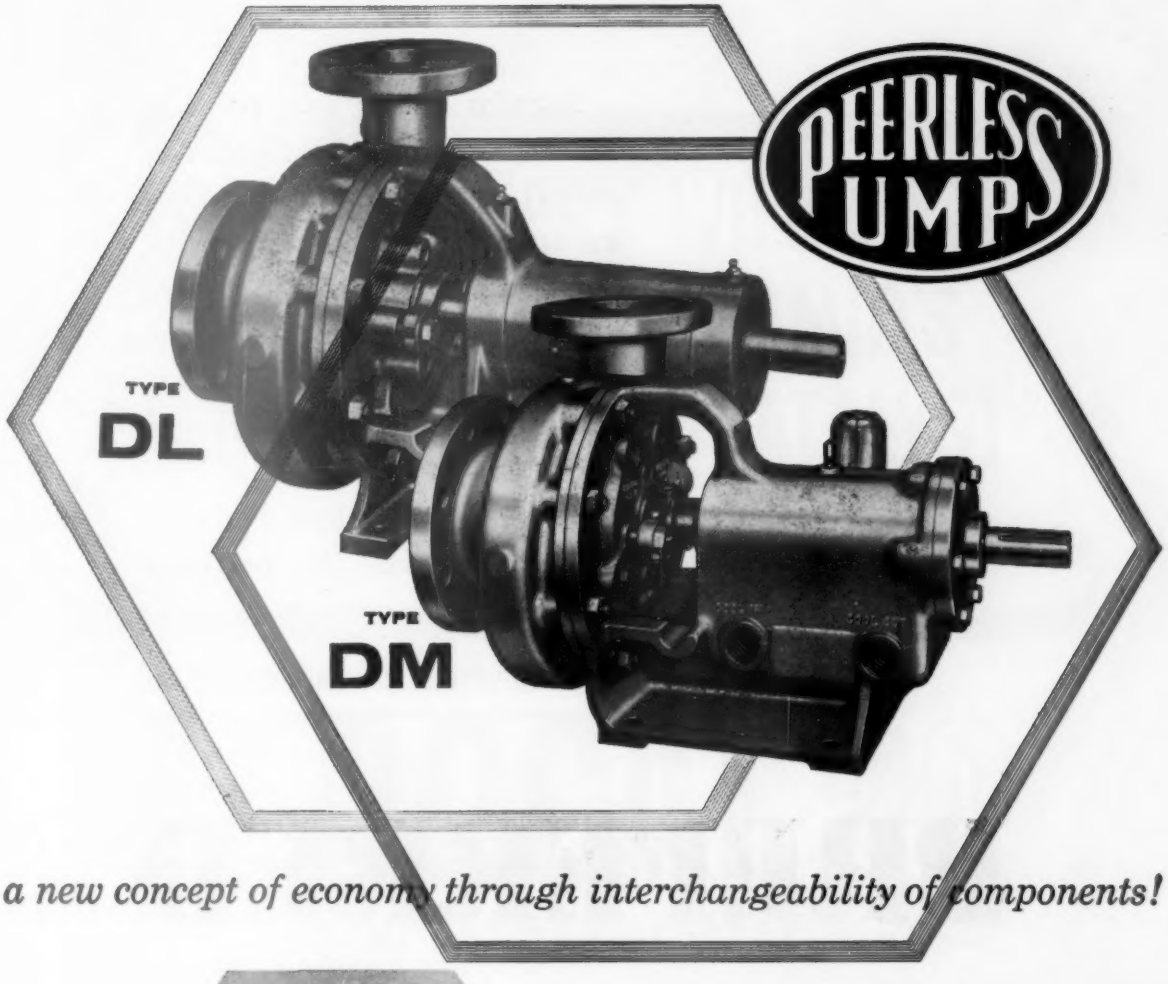


JENKINS VALVES

LOOK FOR THE JENKINS DIAMOND

JENKINS SINCE 1864 Jenkins Bros

Sold Through Leading Distributors Everywhere



a new concept of economy through interchangeability of components!

PEERLESS PUMPS

INTEGRATED ∫ DESIGN

∫ SUPERIOR DESIGN + TOP QUALITY CONSTRUCTION + MAXIMUM INTERCHANGEABILITY + OPTIMUM MATERIAL GROUPS AVAILABLE

= BROADEST HYDRAULIC COVERAGE WITH MINIMUM CUSTOMER INVENTORY OF PUMPS AND COMPONENTS

ACCESSIBILITY—Through ease of assembly and disassembly if and when required. **DURABILITY**—Through use of any machinable metal as materials of construction. **SERVICEABILITY**—Through designs that feature maximum ease of maintenance. **INTERCHANGEABILITY**—Through a choice of semi-open or enclosed impellers, oil or grease lubrication, air- or water-cooled back plates and bearing housings. **RELIABILITY**—Through the high performance standards set for these pumps, proving more than ever before, that Peerless Builds Dependable Pumps. **AVAILABILITY**—Shipment from stock of both complete pumps and pump components.

CAPACITIES: UP TO 1000 GPM • **WORKING PRESSURE:** UP TO 300 PSIG
HEAD RANGE: UP TO 430 FEET • **TEMPERATURE RANGE:** UP TO 450° F

Putting Ideas to Work

fmc FOOD MACHINERY AND CHEMICAL

Peerless Pump
HYDRODYNAMICS DIVISION

Offices:
New York; Detroit; Cleveland; Chicago; Indianapolis; St. Louis; San Francisco; Atlanta; Plainview; Lubbock; Phoenix; Albuquerque; Los Angeles; Fresno.

Distributors in principal cities.
Consult your telephone directory.

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Again last year, over a fourth of all the workmen's compensation insurance bought by Texas employers was bought from TEIA ... far more than from any other company. What better proof of the preference for TEIA's protection.

And what better reason for you to call the nearest TEIA man.

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First choice of Texas Industry for over 45 years

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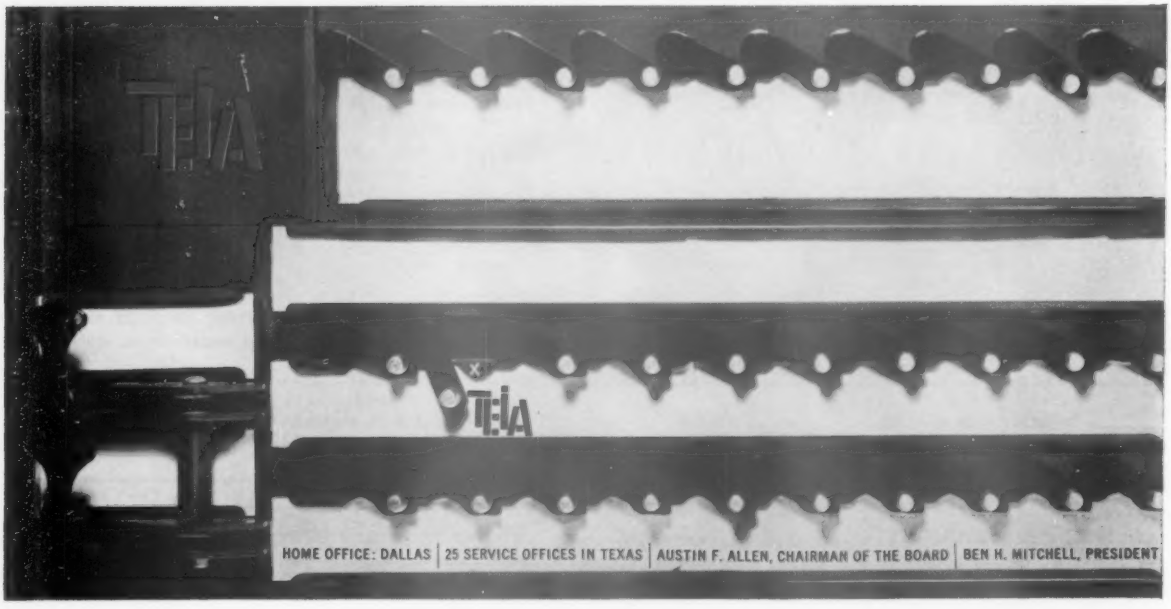


YOUR REFINERY WILL YIELD MORE WITH CYANAMID'S FLUID CRACKING CATALYST COMPOSITION

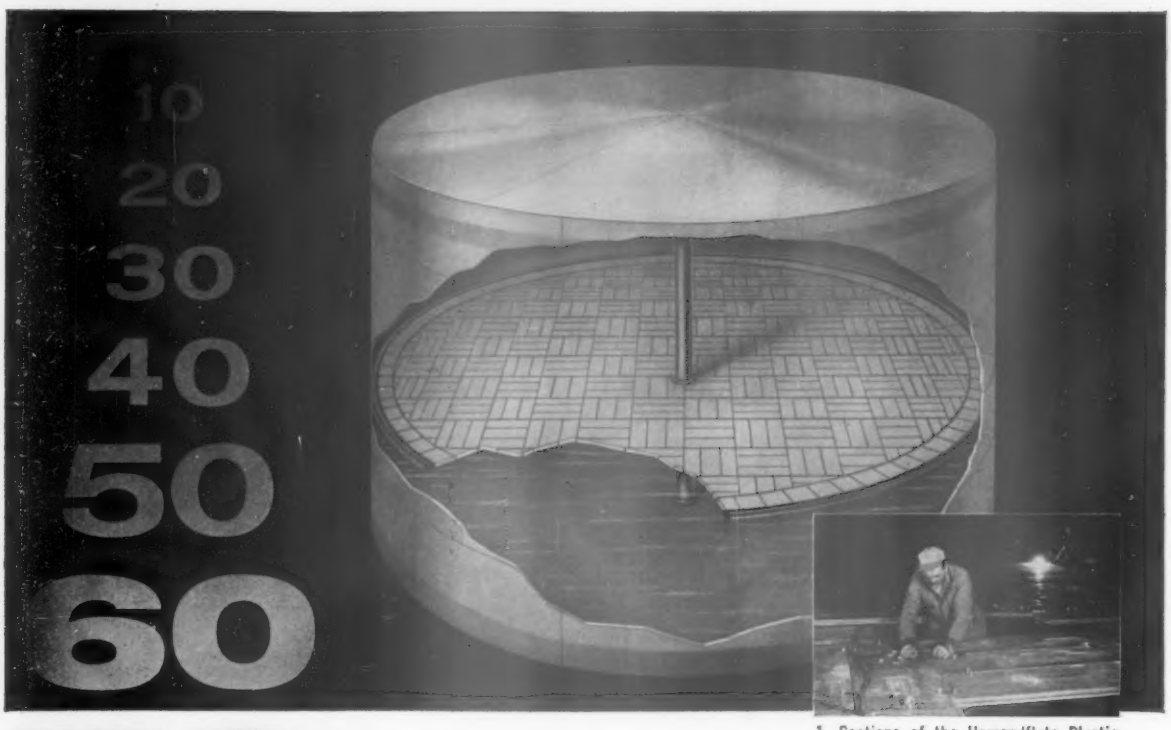
AEROCAT® 3C

THREE COMPONENT CATALYST

MORE GASOLINE OR MORE PROPYLENES, MORE BUTYLENES Cyanamid, in co-operation with a major oil company, has developed AEROCAT 3C—a new fluid cracking catalyst composition. AEROCAT 3C gives refiners more flexible and profitable operations and a greater yield at the expense of dry gas and coke. AEROCAT 3C-12 for increased gasoline yield. AEROCAT 3C-20 for increased propylene and butylene yields. **BASIC IN CATALYST CHEMISTRY**

CYANAMID

AMERICAN CYANAMID COMPANY • REFINERY CHEMICALS DEPARTMENT • 30 Rockefeller Plaza, New York 20, N. Y.



70 ft. HAMONDFLOTE COVER

converts old riveted vessel to modern floating roof tank

A rigid foam plastic Hamondflote Cover was quickly and easily installed in this 70 ft. diameter riveted tank. Using conventional hand tools in a simple assembly operation, maintenance personnel converted the vessel to an efficient conservation tank.

SIZE IS NO LIMITATION . . . the Hamondflote Cover can be used to modernize tanks up to any diameter in use today, regardless of the number or location of supporting columns. It reduces evaporation losses by as much as 95%, is completely resistant to a wide range of chemicals and petroleum hydrocarbons and will withstand temperatures from −94°F. to +300°F.

Write for bulletin which tells the entire Hamondflote Cover story.

1. Sections of the Hamondflote Plastic Cover are easily put together with tongue and groove joints and simple hand-tightened clamps.

2. Here the 70 ft. Cover is almost completed. Note that it is strong and rigid enough to support the workman's weight.

3. Rivets, columns and other protrusions on the inside wall of the tank present no problems. The flexible packing gland easily slides over them when the roof is rising or falling with the liquid level.

HAMONDTANKS

12 plants to serve you coast to coast

PDM
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DOLLARS AND SENSE IN THE SELECTION OF OIL FIELD WIRE LINES

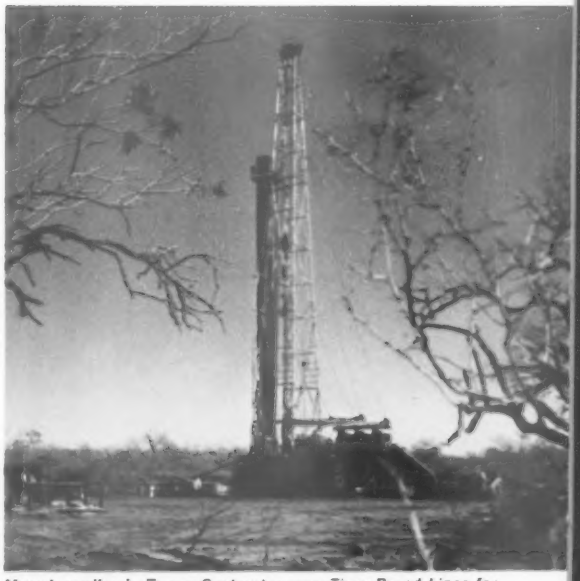
It makes good sense to use the wire line that saves you the most dollars. Millions of feet of hole have been drilled by rigs equipped with USS Tiger Brand Wire Lines. The superior performance of Tiger Brand drilling lines has been recognized throughout the world. As a result of such proved quality, Tiger Brand Wire Lines are more widely used than any other brand.

See next three pages . . .

WHY LEADING CONTRACTORS CHOOSE USS TIGER BRAND—IT SAVES DOLLARS!

Contractors today are caught in a cost-price squeeze. Drilling costs have gone up but the price received per foot of well has remained almost constant. The best way to save money with wire rope is to use the kind that will give you the most service per dollar spent for rope. The experience of hundreds of contractors in all oil fields has proved that USS Tiger Brand Wire Rope is unsurpassed not only for rotary drilling lines, but also for sand lines, casing lines, tubing lines, torpedo lines and other applications.

Tiger Brand field service men are on the job to help you choose the best line for any particular use . . . and you can get Tiger Brand quickly from leading distributors throughout the oil fields. Write for a copy of our booklet, "American Tiger Brand Wire Lines—for Oil, Gas and Water Wells." American Steel & Wire, 614 Superior Ave., N. W., Cleveland 13, Ohio.



More ton-miles in Texas. Contractor uses Tiger Brand Lines for maximum rope life with least down time.

Steel

This mark tells you a product is made of modern, dependable Steel.

Deep drilling in Oklahoma. No trouble with Tiger Brand Lines in drilling below 23,000 feet in one of the world's deepest wells.

Shallow drilling in Kansas. Tiger Brand helps contractor drill a maximum number of wells without changing lines.

Well servicing in Texas. Contractor finds Tiger Brand gives him lowest hourly cost for wire lines.

American Steel & Wire
Division of
United States Steel

PLEASE TURN PAGE

TIGER BRAND WIRE LINE DISTRIBUTORS OFFER QUICK SERVICE AND TECHNICAL HELP

You can get USS Tiger Brand Wire Lines quickly when you need them, from leading supply stores in most oil fields. Each distributor carries complete stocks in various types and sizes of the Tiger Brand Wire Lines used in his area.

To assist you in the solution of wire line specification problems, moving and cutting program analysis, and other technical matters relating to Oil and Gas country wire lines, Tiger Brand Oil Field Technical Representatives are at your service.

Why USS Tiger Brand is your best buy. Tiger Brand Wire Rope is designed by one of the industry's most capable staffs of wire rope engineers. It is made by a company that maintains the most complete research and manufacturing facilities in the steel industry. When you buy Tiger Brand you get the right rope for the job. And your installation is no further away than a phone call to experienced American Steel & Wire field service representatives, or write American Steel & Wire, 614 Superior Avenue, N. W., Cleveland 13, Ohio.

USS and Tiger Brand are registered trademarks

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Columbia-Geneva Steel Division, San Francisco
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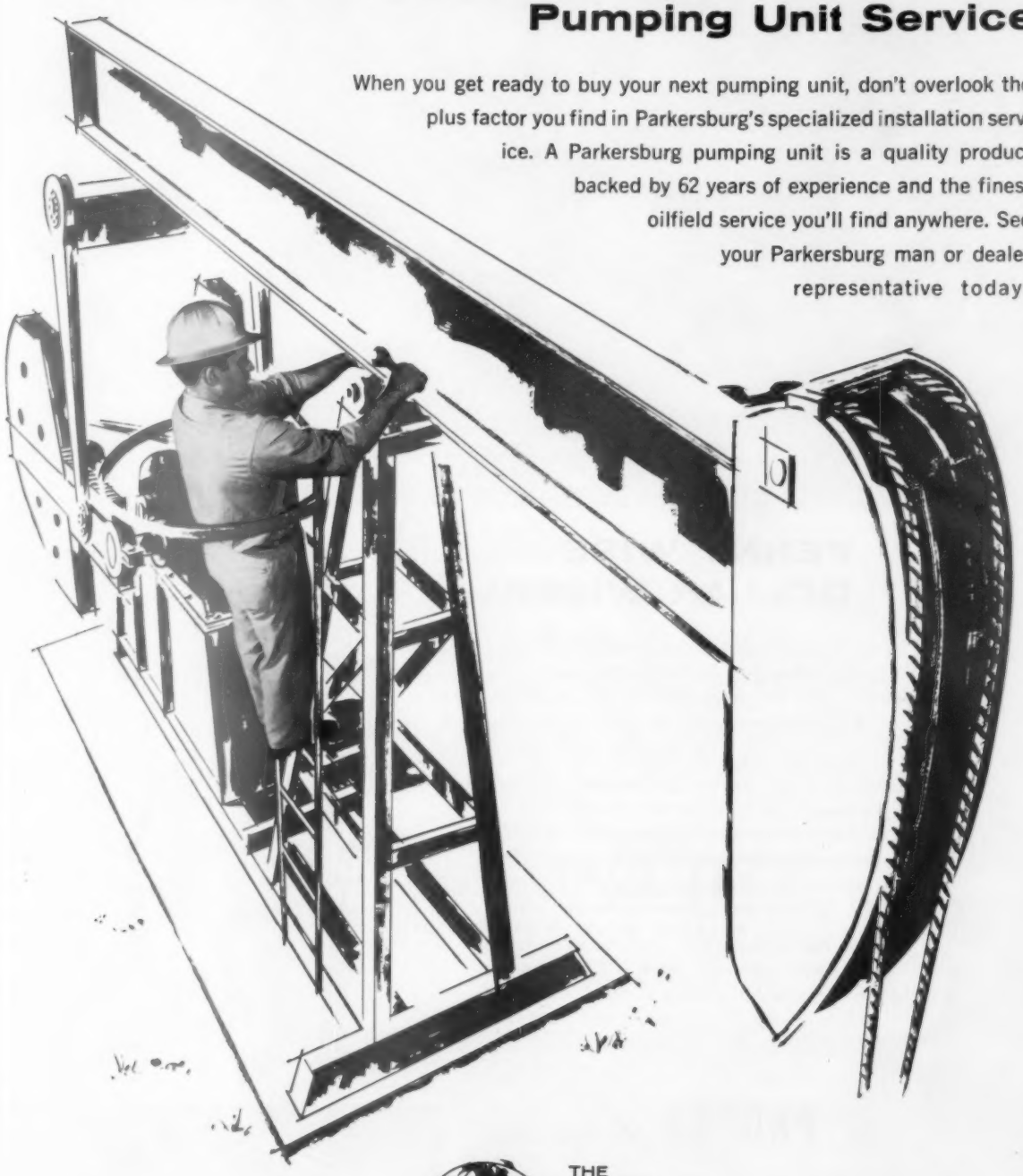
ON TOP OF EVERY JOB!

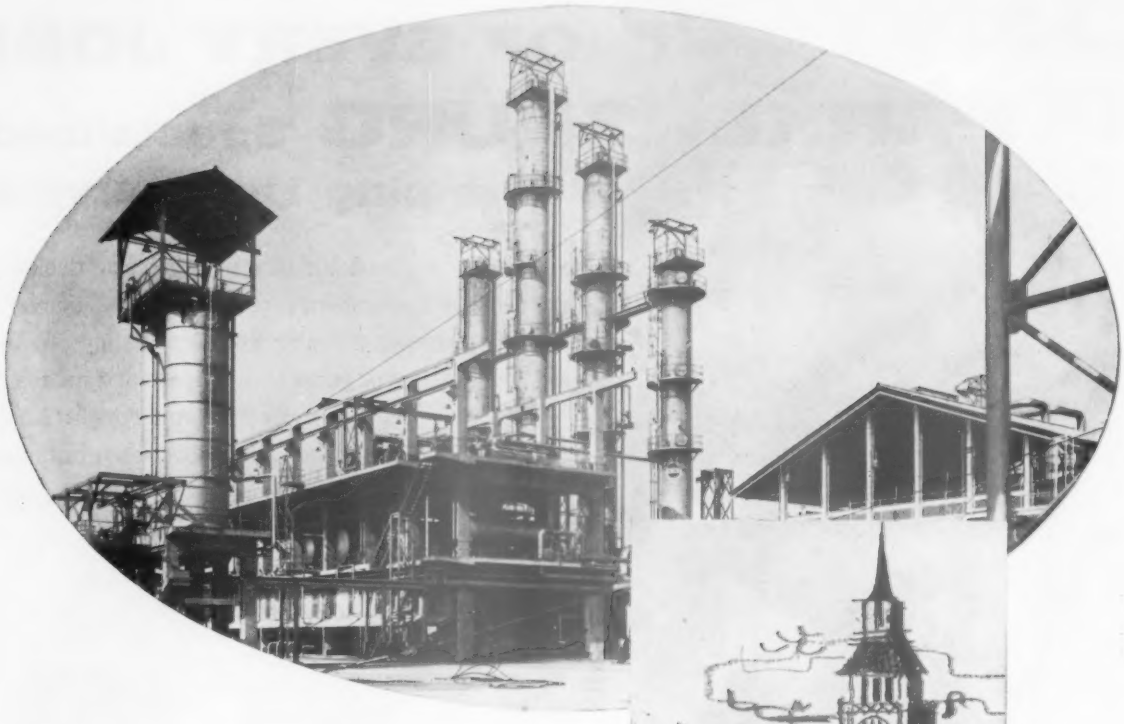
PARKERSBURG Specialized Pumping Unit Service

When you get ready to buy your next pumping unit, don't overlook the plus factor you find in Parkersburg's specialized installation service. A Parkersburg pumping unit is a quality product backed by 62 years of experience and the finest oilfield service you'll find anywhere. See your Parkersburg man or dealer representative today!



Parkersburg Pumping Units Are Available Through the Following Supply Stores: American Pipe & Supply Co., Beacon Supply Co., Bovaird Supply Co., Canadian Equipment Sales & Service Co., Ltd. (Canada), Franklin Supply Co., Franklin Supply Co., Ltd. (Canada), Houston Oilfield Material Co., Inc., Industrial Supply Co., Iverson Supply Co., Mid-Continent Supply Co., Midland Supply Co., Inc., Mountain Iron & Supply Co., Oil Equipment, Ltd. (Canada), The Producers Supply & Tool Co., Republic Supply Co., Rodman Supply Co., Superior Iron Works & Supply Co., United Supply & Manufacturing Co., Wilson Supply Co.

THE PARKERSBURG RIG & REEL COMPANY
Division of Parkersburg-Aetna Corp.
PARKERSBURG • HOUSTON • COFFEYVILLE



PENNY WISE . . . DOLLAR WISER!

Your process construction dollars buy more . . . when you entrust the job to Procon. Construction-wise Procon purchasing men, engineers and other personnel, go all out to get you the most for your money:

They balance cost against performance . . . hold purchases strictly in line with your budget . . . check and recheck components large and small for materials, tolerances, stresses . . . provide a running account of purchases, a constantly current balance sheet, down to the last penny.

Procon builds plants that perform as intended . . . with materials, parts and components bought the way you'd buy them yourself, if you had the necessary time, facilities and personnel.

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Economy in Drilling is a must... *and we're doing something about it.*

Every member of the entire Milwhite organization is continually at work for decreased drilling costs for our customers.

MILWHITE

MILWHITE MUD SALES CO.

HOUSTON, TEXAS

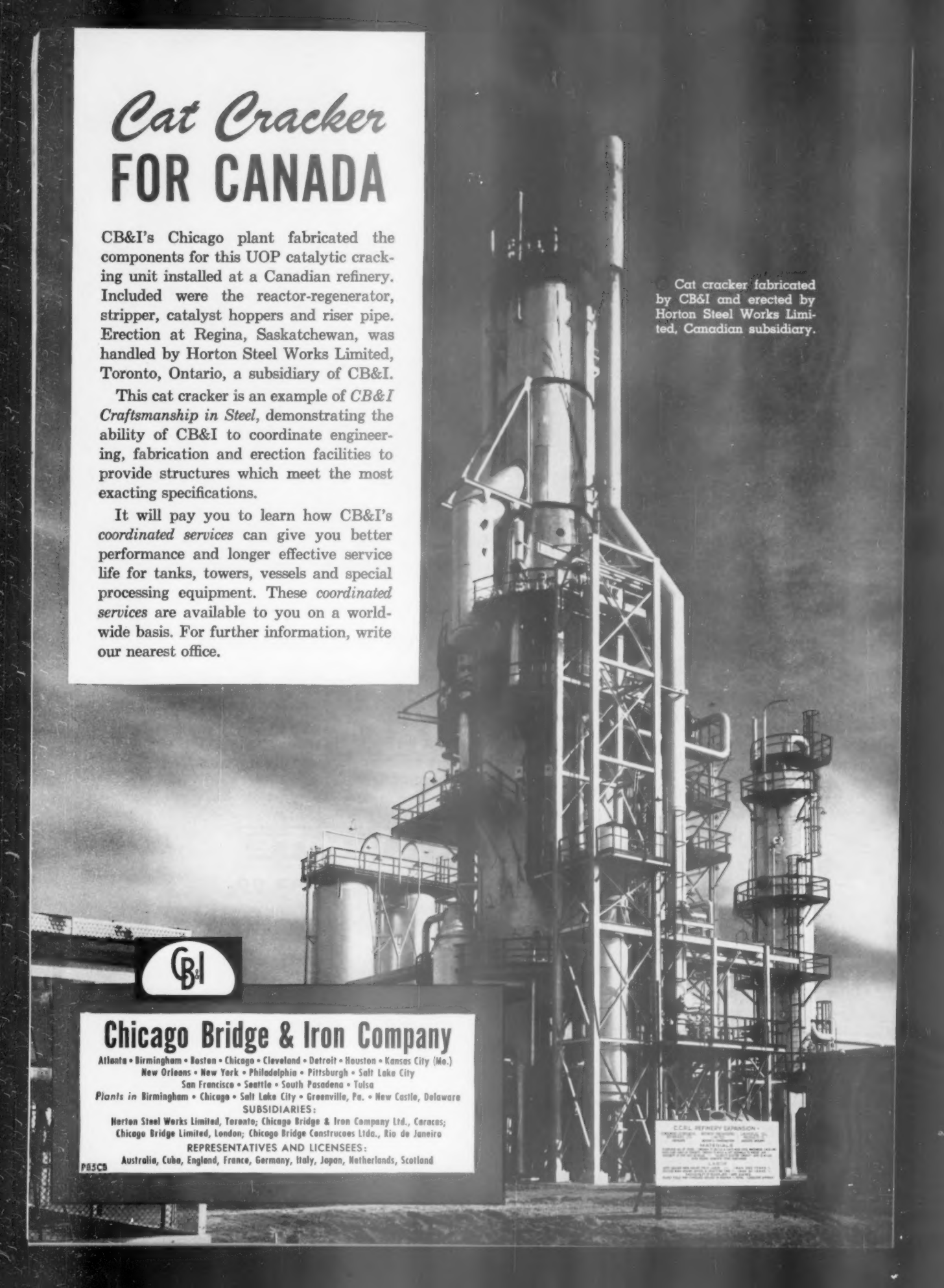
DIVISION OF MISSISSIPPI RIVER FUEL CORPORATION

Cat Cracker
FOR CANADA

CB&I's Chicago plant fabricated the components for this UOP catalytic cracking unit installed at a Canadian refinery. Included were the reactor-regenerator, stripper, catalyst hoppers and riser pipe. Erection at Regina, Saskatchewan, was handled by Horton Steel Works Limited, Toronto, Ontario, a subsidiary of CB&I.

This cat cracker is an example of *CB&I Craftsmanship in Steel*, demonstrating the ability of CB&I to coordinate engineering, fabrication and erection facilities to provide structures which meet the most exacting specifications.

It will pay you to learn how CB&I's *coordinated services* can give you better performance and longer effective service life for tanks, towers, vessels and special processing equipment. These *coordinated services* are available to you on a worldwide basis. For further information, write our nearest office.



Cat cracker fabricated by CB&I and erected by Horton Steel Works Limited, Canadian subsidiary.

CB&I

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston • Kansas City (Mo.)
New Orleans • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • South Pasadena • Tulsa
Plants in Birmingham • Chicago • Salt Lake City • Greenville, Pa. • New Castle, Delaware

SUBSIDIARIES:
Horton Steel Works Limited, Toronto; Chicago Bridge & Iron Company Ltd., Caracas;
Chicago Bridge Limited, London; Chicago Bridge Construcoes Ltda., Rio de Janeiro

REPRESENTATIVES AND LICENSEES:
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P85CB

Better products, *faster*, from your Bower Distributor:

Bower Roller Bearings keep slim-hole rigs mobile and more competitive, too!

You can depend on Bower bearing refinements to minimize friction and keep rigs rolling!

In profitable slim-hole drilling operations, rigs roll safely and swiftly on Bower Spher-O-Honed tapered roller bearings.

That is why it is best to replace any worn bearings from the line most used by leading equipment builders. Built-in qualities of Bower bearings include extra-large flanges for more durability . . . larger oil grooves for better lubricant circulation . . . smoother contact and shoulder radius design. These combine to put Bower bearings *out front* in delivering big tonnage with unequalled dependability.

Your Bower Bearing Distributor assures you of fast delivery in tapered or straight roller bearings. Call him to fill your next replacement need.

BOWER ROLLER BEARINGS

FEDERAL-MOGUL SERVICE

DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC. • DETROIT 13, MICHIGAN

BEARING BOWER ROLLER BEARINGS SERVICE

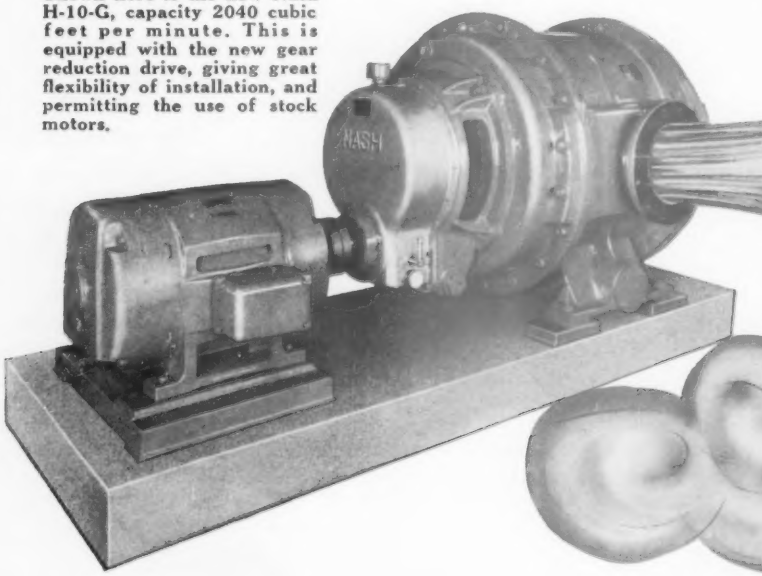
Nash Compressors Tame "Hard-to-handle" Corrosive Gases

The reasons for the success of Nash Compressors in handling "dirty" and corrosive gases are simple. First, Nash Compressors have no internal parts in wearing contact, or requiring close tolerances and internal lubrication. Second, because of the Nash operating principle, a variety of liquids can be employed as the compressant medium, protecting the interior from corrosive action. Third, the pump casing may be fabricated from a variety of special metals and alloys. That is why Nash Compressors take these rugged jobs in stride.

Nash Vacuum Pumps offer the same basic advantages when handling corrosive gases, and reliably maintain vacuums up to 29.50 inches of mercury.

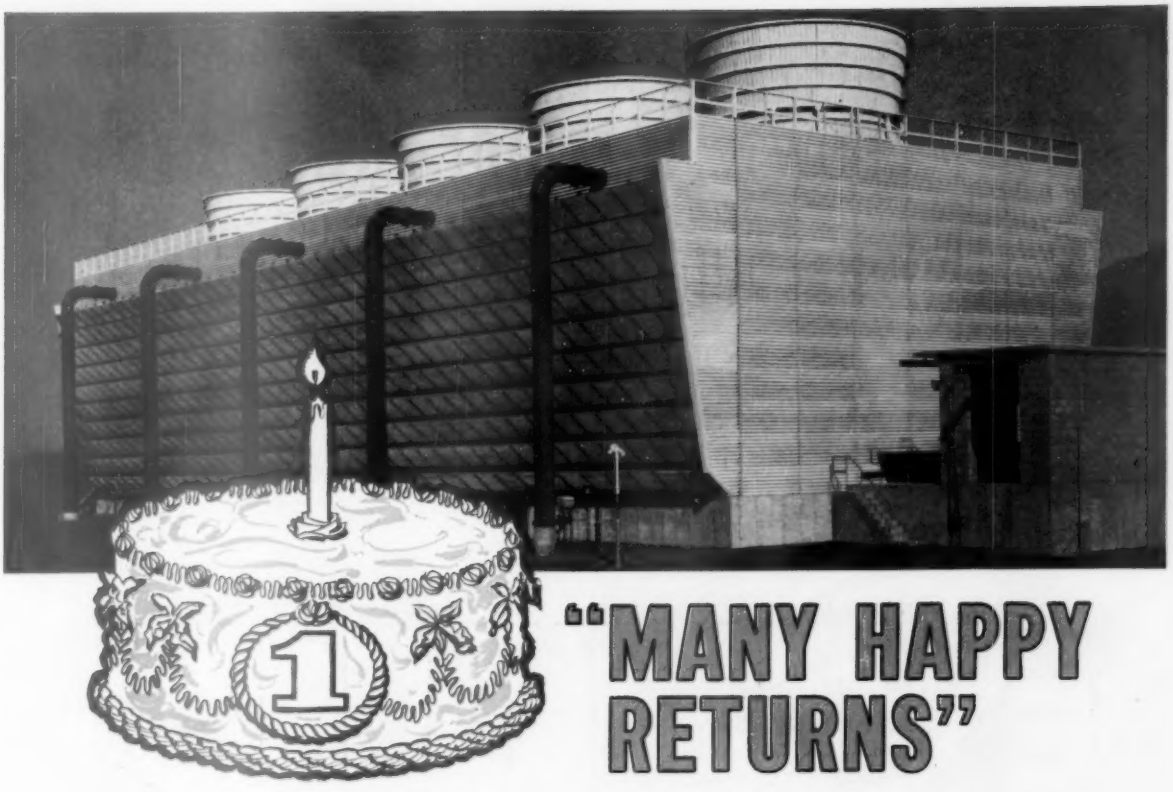
ACETONE
ACETYLENE
AMMONIA
ARGON
BUTADIENE
CARBON DIOXIDE
CARBON MONOXIDE
CHLORINE
ETHYL CHLORIDE
FLUE GAS
FURFURAL
HEXANE
HELIUM
HYDROGEN
HYDROGEN SULPHIDE
NITROGEN
OXYGEN
PHOSPHOROUS PENTOXIDE
SULPHUR GAS
VINYL ACETATE
VINYL CHLORIDE
AND MANY OTHERS

Shown here is the new Nash H-10-G, capacity 2040 cubic feet per minute. This is equipped with the new gear reduction drive, giving great flexibility of installation, and permitting the use of stock motors.



NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.



"MANY HAPPY RETURNS"

This Class 600 Marley Double-Flow cooling tower is one year old . . . and in excellent condition functionally, mechanically and structurally. To assure many more "happy" anniversaries over a long future, The Marley Company will never relax vigilant attention to every detail of its welfare.

Like all Class 600 towers, it will be under the surveillance of a member of the Marley Service Engineering staff, experts on cooling tower operation and maintenance. The results of their services are best attested by supervisory engineers and executives in plants where Class 600 towers are now in service:

ENGINEER, GENERATING STATION:

"We have greatly appreciated the service you have rendered. We had little experience with towers before these four units were put in operation, but we have received much help from your service engineer. Periodic inspection by someone who knows towers relieves us of the worry of letting our towers degenerate. Our supervisors always look forward to these visits and have plenty to discuss with your engineers. Your service has been good and we hope we can continue along this way with the new tower which you will soon be building here."

MANAGER, NUCLEAR PLANT:

"It is our opinion that mutual benefit has been derived from the periodic visits of your service engineer. We know that this service has given us experienced assistance in operational, mechanical and wood deterioration problems."

REFINERY ENGINEER:

"The Marley service engineer has been a most helpful person to work with and has always been ready to come and help us. His recommendations have been fair, honest and unbiased. That is why we have always accepted them. We would be very disappointed if this service was not available; we have come to depend on it."

MUNICIPAL POWER SUPERINTENDENT:

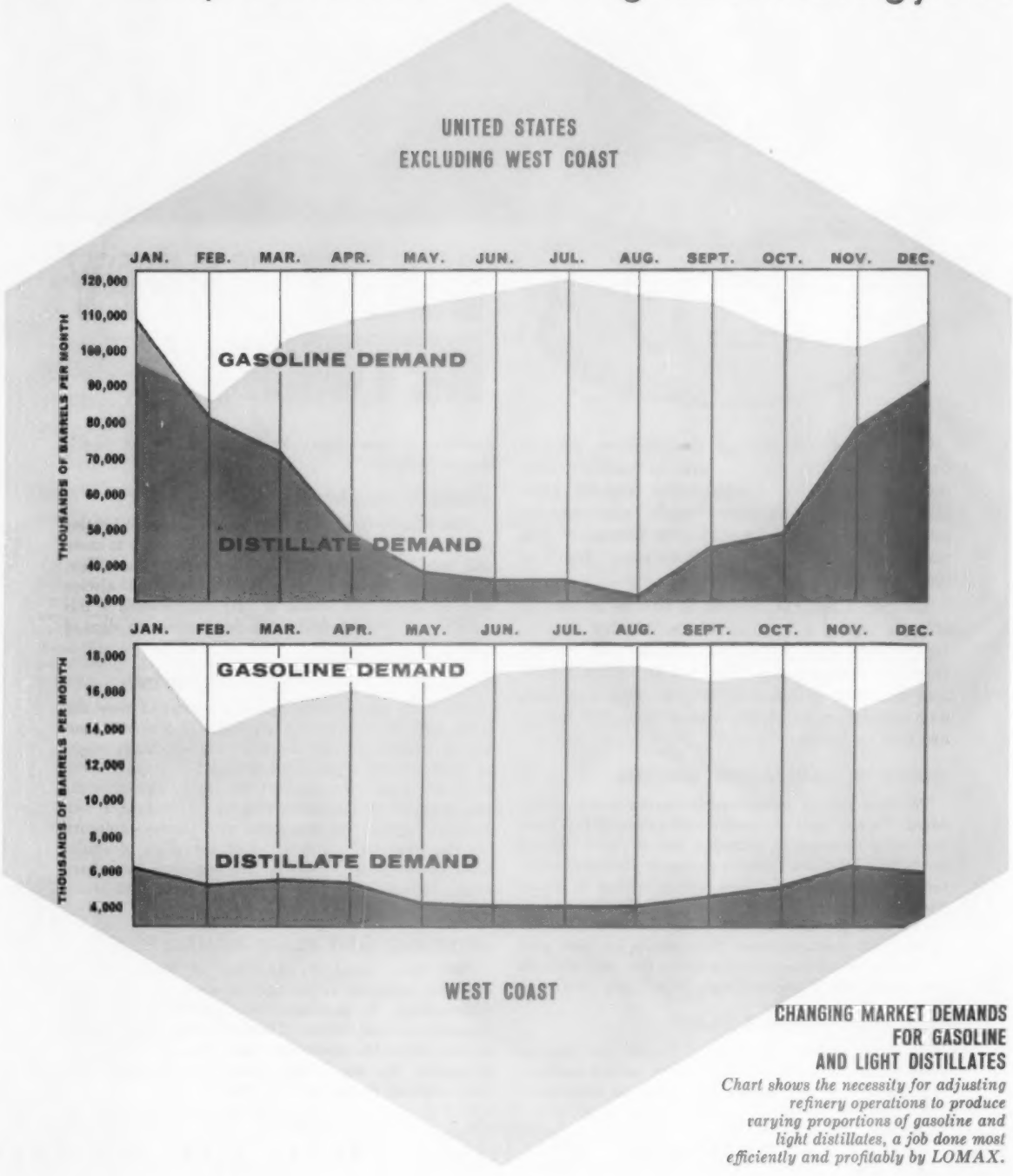
"From the power plant operator's point of view this is the best service you can give! I will welcome your service engineers at all times. There are many pieces of equipment in a power plant and it is impossible to give each piece of equipment the loving care that the manufacturer would like it to have. Therefore, I welcome an opportunity to discuss, with service engineers, the operation and maintenance of any piece of equipment in the plant. Your service engineers have been most courteous and helpful. I hope that I shall see more of them in the future."

PETRO-CHEMICAL PLANT MANAGER:

"We have found the attention of Marley service engineers beneficial to our cooling tower operation and maintenance. In particular, we appreciate the latest inspection of our towers. This service has been helpful to our preventive maintenance and cooling tower repair programs. We are looking forward to working with your engineer during an early visit."

THE MARLEY COMPANY MARLEY KANSAS CITY, MISSOURI

now...**a major breakthrough** in petroleum refining technology...



CHANGING MARKET DEMANDS FOR GASOLINE AND LIGHT DISTILLATES

Chart shows the necessity for adjusting refinery operations to produce varying proportions of gasoline and light distillates, a job done most efficiently and profitably by LOMAX.

LOMAX

TRADEMARK

the versatile **new UOP** process

Here is a new and vastly important process to which every refiner should give serious consideration—now! Regardless of present markets and whether existing facilities are old or up-to-the-minute, LOMAX may prove economically attractive through *increased year-'round production of your most saleable products.*

Through the reaction of oil with hydrogen in the presence of a new UOP catalyst, LOMAX converts middle distillates, ranging from kerosines to heavy gas oils, into a wide ratio of gasoline or distillate fuels. This highly flexible process may be used to supplement existing facilities, or as a basic cracking operation in a new installation.

Advantages offered by LOMAX also include: Predominance of branched isomers in light hydrocarbons . . . greatly reduced quantities of light gases . . . olefin-free products . . . no catalyst deposit . . . distillates of exceptional high purity (even from sour crudes) . . . and other important benefits.

- **LOMAX** produces **maximum saleable product**...up to 120 barrels of product from 100 barrels of charge stock.
- **LOMAX** gives you **maximum production** of the product you want when you want it...whether gasoline or light distillates.

UOP®

Write for detailed technical information. Address:

UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road, Des Plaines, Illinois, U. S. A.

WHERE RESEARCH TODAY
MEANS PROGRESS TOMORROW

HUMBLE COREXIT

Save time and money previously lost to internal corrosion: use Humble COREXIT . . . COREXIT effectively and economically prevents internal corrosion in pipe still overhead, distillation towers, vapor recovery systems and other refining units. COREXIT will reduce or completely eliminate plugging or fouling. This protection against sludge, scale and corrosion cuts non-productive downtime to a minimum. For complete information on technical services and products, contact your Humble salesman.

HUMBLE

HUMBLE OIL & REFINING COMPANY

ELECTRONIC PIPE LINE CONTROL?

This Taylor system gives you these customary features—

- *No transmission lag*
- *Can be used for remote measurement—over limitless distances*
- *Exceptionally fast speed of response*

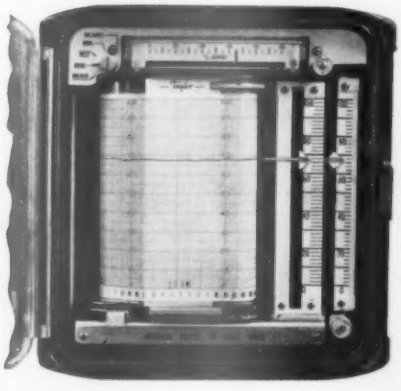
without sacrificing *Dependability* and *Quality*. Here's why:

No. 700R Electronic Controller

- Provides smoother transfer of suction discharge pressure and/or flow override control because there is no "reset wind-up".
- Much faster than any other electronic controller—flat out to 120,000 cpm.
- Rate action available down to 0.0016 mins.
- Gives smooth start-up on booster stations because diode limiter circuit eliminates reset wind-up.

No. 707T Electronic DP Transmitter (Left)

- Extremely reliable for unattended stations. Has no vacuum tubes, no transistors. Unaffected by vibration.
- Ideal for use where paraffin is present because nothing exposed to the process except end plates (steel or 316 stainless steel) and 316 stainless steel diaphragms.
- Can be used with reciprocating as well as centrifugal compressors because of internal silicone damping—continuously adjustable to damp out pulsations from 5 to 100 cpm.
- Cannot be damaged on remote station start-up because of full overrange protection to 1500 psi—either high or low sides.



No. 700J AC or DC Electronic Recorder (Left)

- Powerful servo motor provides accuracy of ½ of 1%, sensitivity to changes of 0.1% in input signal.
- Simplified tie-in of subsequent operations or auxiliary equipment permitted by operation of integral servo-operated alarms.
- Big 4" rectilinear chart gives 30 day record (1" per hour).
- Completely transistorized, unaffected by ±10% line voltage variation.

• • •

Call your Taylor Field Engineer, or write for appropriate bulletin.
Taylor Instrument Companies, Rochester, N.Y., or Toronto, Ont.

Taylor Instruments **MEAN ACCURACY FIRST**

Kellogg Cures Sulfur Headaches

with Low-Cost Hydrotreaters

KELLOGG-DESIGNED UNITS REDUCE CORROSION, INCREASE CATALYST LIFE AND SELECTIVITY, IMPROVE PRODUCT QUALITY WITH LESS TEL

With less low sulfur crude available today, and product specifications increasingly difficult to meet, a Kellogg hydrotreater is the refiner's answer to the many refining, storage and marketing problems presented by high sulfur-content feedstocks.

Working closely with the refiner's engineers, as it has done with those of leading oil companies throughout the United States—as well as in Canada, South America, Europe, Asia and Australia—Kellogg can design a unit that will remove harmful sulfur compounds to almost any degree desired, and also permit decrease of TEL.

Optimum investment and operating costs are also assured through designs that utilize selective pressures, reduce the use of costly alloys such as 18-8, and lower the consumption of high pressure hydrogen.

A Record in Desulfurization

To date, as shown at right, Kellogg has engineered and/or erected 17 reformer feed hydrotreaters—with a total capacity of over 161,000 BPSD, and 13 distillate hydrotreaters—with a total capacity of over 164,000 BPSD.

To acquaint you further with desulfurization by hydrotreating, Kellogg will gladly send you copies of a recent paper written by two of its engineers and reprinted from "Petro/Chem Engineer."

THE M. W. KELLOGG COMPANY

711 Third Ave., New York

A subsidiary of Pullman Incorporated

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REFORMER FEED DESULFURIZERS	
Heath, Ohio	3,000 BPSD
Houston, Texas	24,000 BPSD
Bakersfield, Cal.	4,000 BPSD
Kent, England	10,000 BPSD
Grand Prairie, Alberta	875 BPSD
Antwerp, Belgium	2,500 BPSD
Toledo, Ohio	22,000 BPSD
Ponca City, Okla.	16,000 BPSD
Dunkerque, France	10,000 BPSD
Lemont, Ill.	18,000 BPSD
Vancouver, B.C.	7,200 BPSD
Kwinana, Australia	10,000 BPSD
Montevideo, Uruguay	3,000 BPSD*
Concon, Chile	6,000 BPSD
Dinslaken, Germany	10,000 BPSD*
Antwerp, Belgium	10,000 BPSD
Turkey	4,600 BPSD*
DISTILLATE DESULFURIZERS	
Kwinana, Australia	5,600 BPSD
Port Arthur, Texas (2)	45,000 BPSD
Philadelphia, Pa. (2)	45,000 BPSD
Martigues, France	12,500 BPSD
Kent, England (2)	20,000 BPSD
Antwerp, Belgium	10,000 BPSD
Clarkson, Ont.	8,000 BPSD
Vancouver, B.C.	4,000 BPSD
Dinslaken, Germany	10,000 BPSD*
Turkey	4,500 BPSD*

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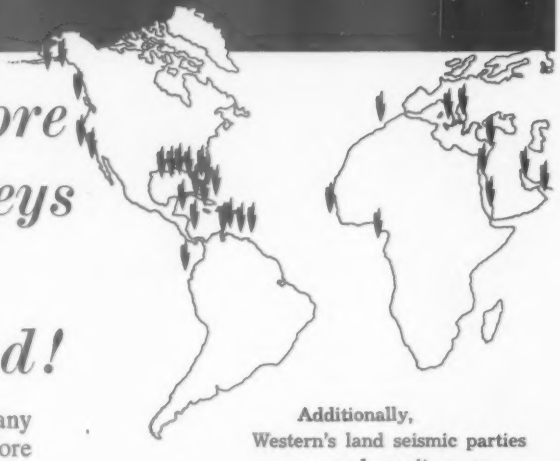

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This record reflects the considered judgment of many of the most respected people in the petroleum industry on the competence of Western men, techniques and instrumentation. When you consider your next geophysical survey, let us tell you more about the Western services that have earned and held such confidence.

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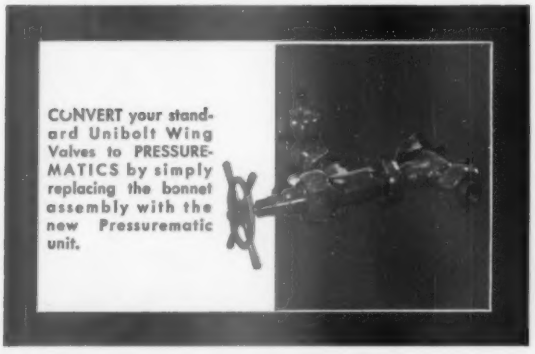
The New Unibolt Pressurematic Wing Valve

- ***Automatically shuts in the well when flowline pressures rise or fall beyond desired limits.***
- ***Permits manual operation for choke changing.***

A broken flowline or the failure of any unit in the separator, heater-treater, or gathering manifold that would cause the flowline pressure to *drop,* would automatically and instantly close the Pressurematic Wing Valve and shut in the well. Any obstruction in the flowline, such as paraffin, that would cause the flowline pressure to *rise,* would also actuate the Pressurematic Valve to closed position.


CONVERT your standard Unibolt Wing Valves to PRESSUREMATICS by simply replacing the bonnet assembly with the new Pressurematic unit.

No springs are employed in the Pressurematic Valve. Its design incorporates the long-established engineering principle of balancing a small diameter piston which is exposed to high pressure (wellhead) against a large diameter piston which is exposed to low pressure (flowline). When this balance is disturbed — in excess of pre-determined limits — the pistons move and thus actuate the gate, or stem. This movement is to the closed position only. When the valve closes it can be opened with the handwheel and reset for automatic operation. The handwheel also permits manual operation of the valve for choke changing, etc.

Complete details will gladly be sent on request.

THORNHILL CRAVER CO.
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Engineering Progress Report
FROM UNION CARBIDE CHEMICALS COMPANY

Acetonitrile boosts butylene throughput 58%, saves $3,000,000 capital investment

Unusual solvent useful in saturate-unsaturate and olefin-diolefin separations

By using acetonitrile as an extractive distillation solvent, Shell Chemical Corporation has boosted throughput of the existing butadiene feed-preparation unit 58% in their Torrance plant. Minor engineering changes for the unit cost $148,000: it has been estimated that a similar throughput increase through new construction would cost about $3,000,000. Development work and operating experience have shown that acetonitrile's unusual solvent properties should prove useful in other saturate-unsaturate and olefin-diolefin separation processes.

ADVANTAGES OF ACETONITRILE

Acetonitrile has boosted capacity in the Shell plant because it increases the spread in boiling points of the C_4 hydrocarbons being distilled. Thus, separation of the hydrocarbons is more efficient than with either acetone or furfural. Relative volatility of n-butane compared to butene-1 is about 1.25 with acetone and about 1.30 with furfural. Acetonitrile increases this ratio to almost 1.4. The spread in boiling points of butene-1 and butadiene is also increased. The table gives data on the relative volatilities of C_4 hydrocarbons in aqueous acetonitrile systems.

After the extractive distillation has been completed, acetonitrile can be completely recovered from the butane and butylene streams with greater ease than acetone. This increased recovery efficiency is due to the high distribution coefficient of acetonitrile in water/hydrocarbon systems.

ENGINEERING CHANGES MINOR

Because of the similarity of the physical properties of acetonitrile and acetone, it is not necessary to change the operating pressure of extractive distillation columns. Shell engineers made only minor changes to their unit. Besides a larger reboiler and a new pump, two heat exchangers were switched and the solvent recovery column was connected to vacuum operation. Aqueous acetonitrile systems do not foul exchanger systems. Corrosion due to hydrolysis of solvent at reboiler temperatures is minimized by pH control.

TABLE 1 RELATIVE VOLATILITIES OF THE C_4 HYDROCARBONS IN AQUEOUS ACETONITRILE, 120 psia

Component	Total Solvent Concentration, 80%m		Total Solvent Concentration, 85%m	
	Water in Solvent 15%m	Water in Solvent 25%m	Water in Solvent 15%m	Water in Solvent 25%m
Isobutane	1.638	1.673	1.637	1.674
n-Butane	1.332	1.347	1.348	1.368
Isobutylene	1.013	1.013	1.013	1.013
Butene-1	**1.000**	**1.000**	**1.000**	**1.000**
t-Butene-2	0.861	0.856	0.865	0.861
cis-Butene-2	0.821	0.813	0.827	0.820
Butadiene-1, 3	0.639	0.599	0.645	0.604
Water	0.08	0.045	0.075	0.045
Acetonitrile	0.043	0.033	0.043	0.033

OPERATING COST REDUCTIONS

The butadiene feed-preparation unit operating on acetonitrile has less solvent-loss than one operating on acetone. *Thus, solvent make-up costs are no higher with acetonitrile than with acetone.* Steam and pumping costs have also been reduced because reflux and circulation rates are lower. This is true even at reduced feed rates.

ACETONITRILE USEFUL IN OTHER PROCESSES

Acetonitrile is effective in other saturate-unsaturate and olefin-diolefin separations. This heat-stable extractant is useful in ethylene-ethane, propylene-propane, and cyclopentadiene-cyclopentane separations. The boiling point spreads between pentadienes, such as isoprene, and pentenes are also increased.

In liquid-liquid extraction processes, acetonitrile is effective in removing tars, phenols, and color bodies from hydrocarbons. Acetonitrile is also useful as a selective solvent for fatty acids.

INFORMATION AVAILABLE

If you're looking for increased efficiency in your extractive distillation or liquid-liquid extraction processes, acetonitrile could be the answer. Detailed information on acetonitrile as an extractive distillation solvent along with information on azeotropic mixtures of acetonitrile is available. For this information, call the nearest CARBIDE Technical Representative—or write, Department B, Union Carbide Chemicals Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, New York.

Nothing herein shall constitute a recommendation to practice any invention covered by any patent without permission of the patent owner.

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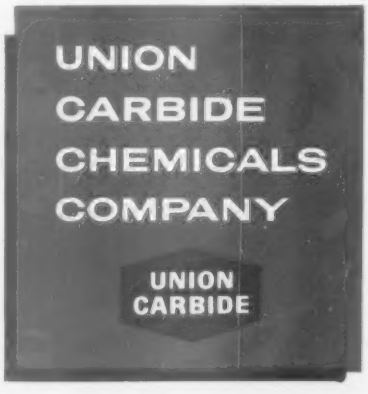

e-con -o-my management with special regard for costs . . . and directly concerned with maintenance or productiveness. WEBSTER

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ROEBLING ROYAL BLUE WIRE ROPE This is rather a long view of a wire rope that's a real work horse. Time and tests have taught us at Roebling that wire rope users *want* the long view. What else, they say, are they spending their money for?

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We have to know that the rope we build will do what we sell it to do. Numerous quality-control measures help us—as they do you—to take the long view of Royal Blue. For details about long-lasting Roebling Royal Blue, ask your wire rope distributor or write Roebling's Wire Rope Division, Trenton 2, New Jersey.

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Large Louis Allis motors shrug off abuse... resist corrosion... run for years indoors and outdoors in unattended locations

No job is too tough for these large-frame explosion-proof motors. You can install them in the plant or in remote outdoor locations and virtually forget them. They'll give you long, trouble-free service with a minimum of attention.

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Special Louis Allis varnishes insulate motors against heat, moisture, and corrosive gases and liquids. This, plus the heat-dissipating housing surfaces and controlled air flow, keeps motor temperature at a safe operating level. All parts are precision-machined and dynamically balanced for smooth, quiet operation. Rugged split-sleeve bearings are well lubricated and effectively sealed to keep oil in, dirt and water out . . . can be easily replaced when necessary.

Standard ratings for Louis Allis enclosed and explosion-proof motors range up to 700 hp. They're available with electrical and mechanical modifications to meet every need. Ask your Louis Allis District Office for Bulletin No. 1950—or write The Louis Allis Co., 449 East Stewart Street, Milwaukee 1, Wisconsin.

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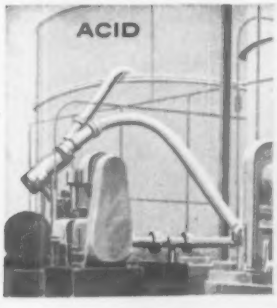

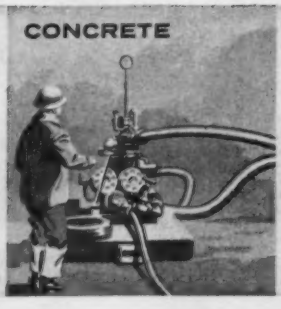

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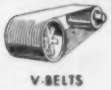
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Think of the savings—in time *and* money—this weed killer offers you! UREABOR is the special granular weed killer meeting all requirements of industrial users. A little does a lot! One DRY application of only 1 to 2-lbs. per 100 sq. ft. creates weed-free areas anywhere for a whole year! UREABOR is safe, effective, economical and convenient. It's always ready for use direct from the bag—in the easiest possible way—to destroy weeds and protect your property from grass fires.

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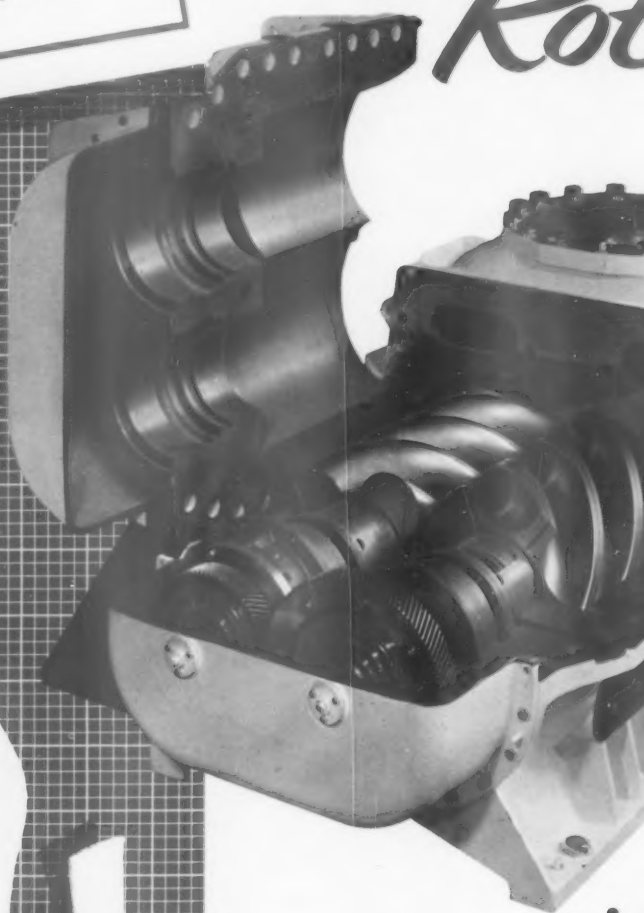

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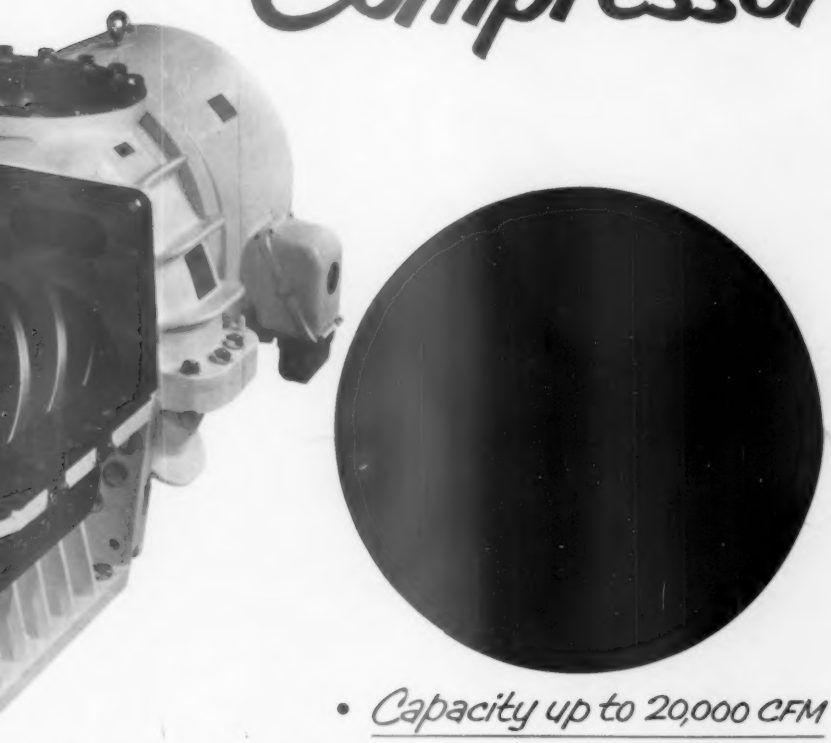

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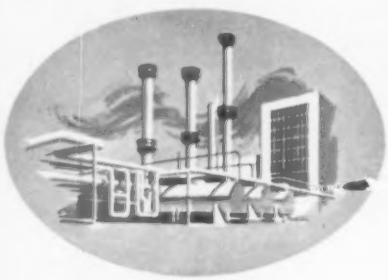

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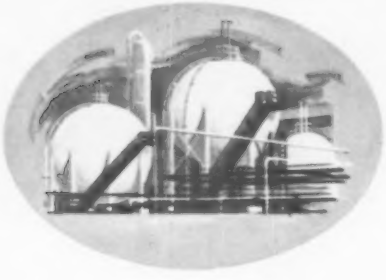

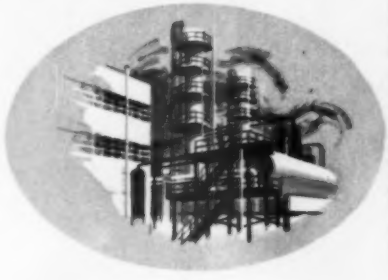

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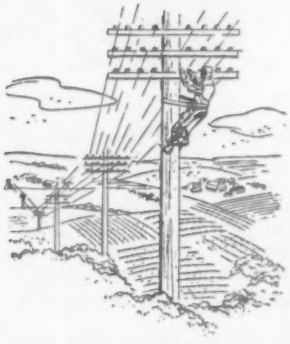

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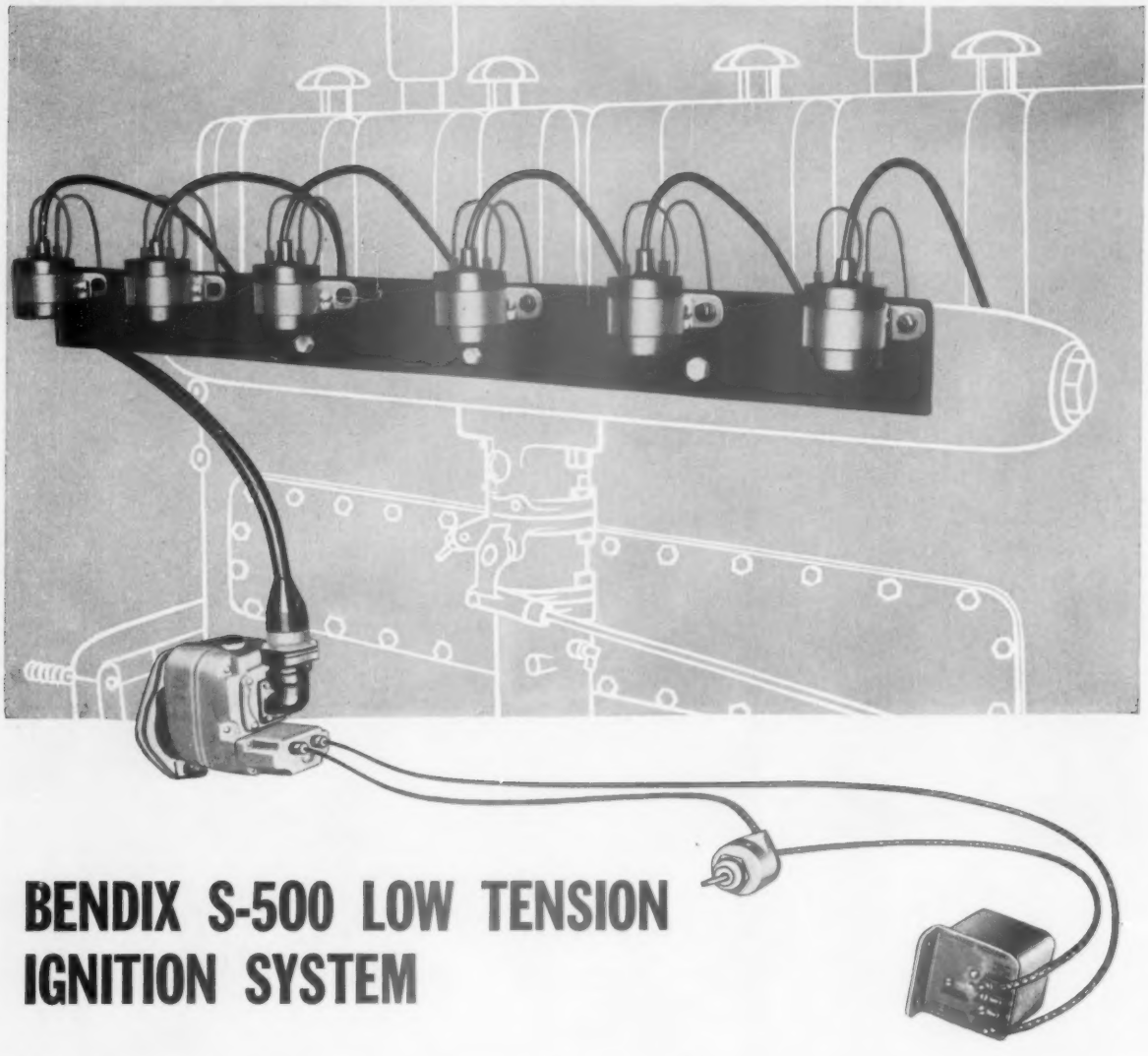

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Armco Steel Line Pipe... Controlled for High Quality

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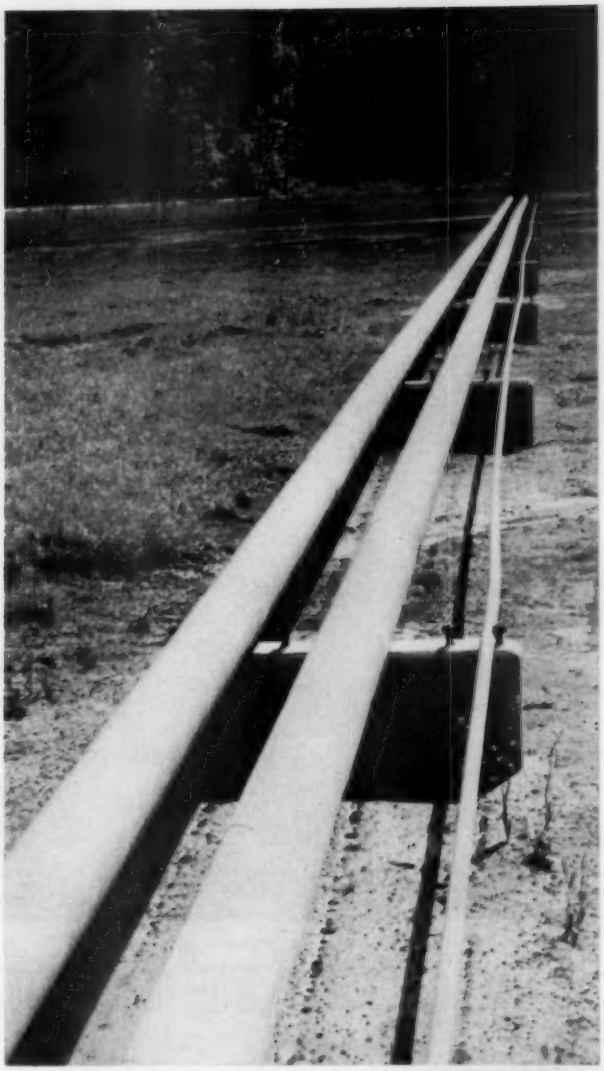
Because Armco is a fully integrated steel company, all products are carefully checked, carefully controlled at every step. Armco Line Pipe, for example, is tested and re-tested in every stage of its development—from the raw material through the basic steel-making process to the fabrication of the pipe itself.

The result: stronger, more economical line pipe to serve your oil and gas needs. Split-ring tests show that the maximum residual stress in Armco Pipe is about 90 per cent less than in many other standard pipes. More strength remains in Armco Pipe to meet unforeseen or accidental overloads. And with 132 diameter-wall thickness combinations, you buy only the steel you need to meet your requirements.

For more information about Armco Line Pipe, fill out the attached coupon and mail it to Armco Drainage & Metal Products, Inc., 7150 Curtis Street, Middletown, Ohio.



New steels are born at Armco

ARMCO DRAINAGE & METAL PRODUCTS, INC.
7150 Curtis Street, Middletown, Ohio

Have your sales engineer contact me for an appointment to discuss Armco Welded Steel Pipe for the oil and gas industries.

NAME_____

TITLE_____

COMPANY_____

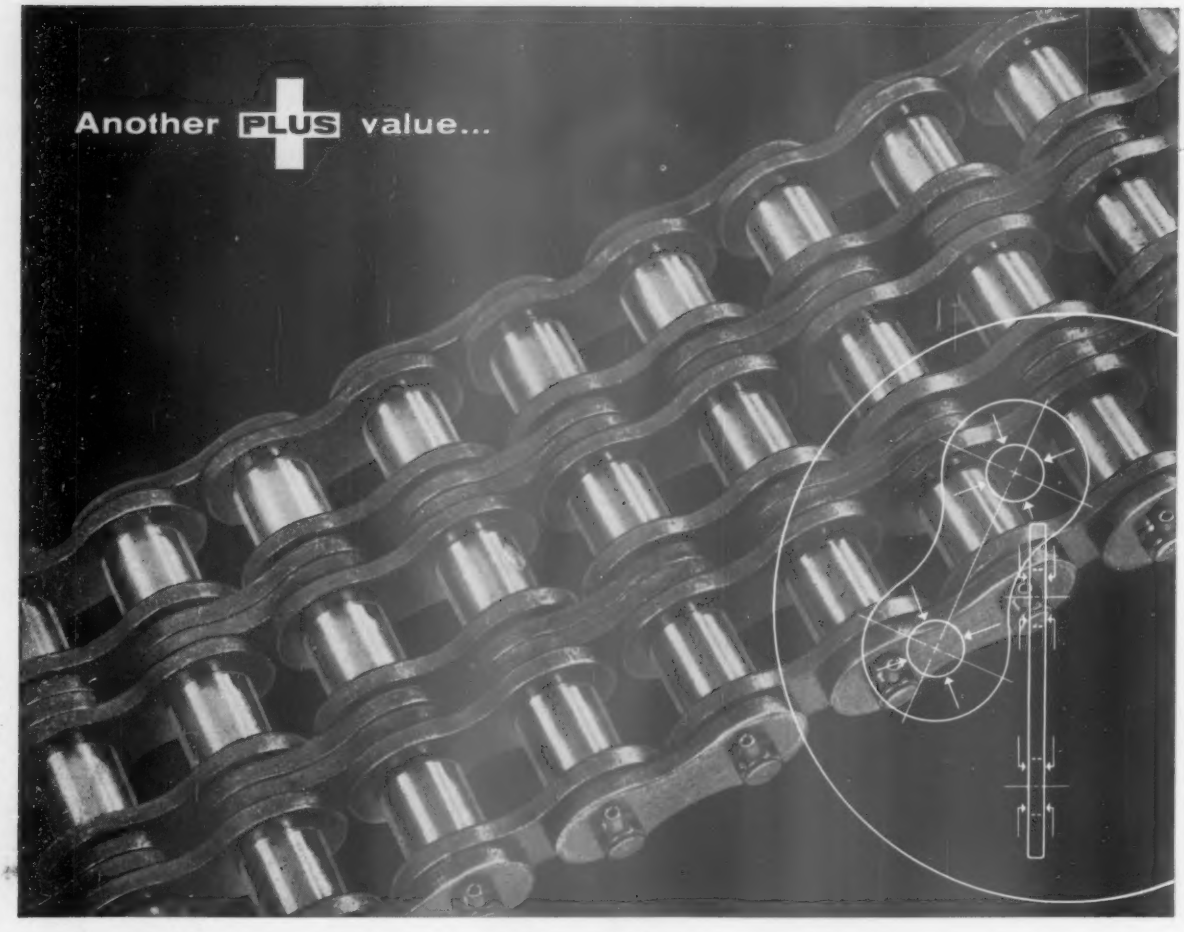
ADDRESS_____

CITY_____ ZONE____ STATE_____

ARMCO DRAINAGE & METAL PRODUCTS

Subsidiary of ARMCO STEEL CORPORATION

OTHER SUBSIDIARIES AND DIVISIONS: Armco Division • Sheffield Division • The National Supply Company • The Armco International Corporation • Union Wire Rope Corporation



ACCURATE PLATES FOR HIGHEST FATIGUE STRENGTH

To protect against fatigue failures, the link plates of an oil field roller chain must be manufactured to exceptionally close tolerances. In Rex Oil Field Roller Chains this accuracy is assured through a unique manufacturing technique.

Link plate holes are precisely located in relation to each other and are parallel. They are accurate in size throughout the thickness of the link, and hole finish is smooth and uniform. This is accomplished by guide-piercing the holes.

Beneficial stresses are built into the link plate holes by ball-swaging to provide extra fatigue strength at these important points. The combination of these advantages adds up to the plus value of pitch control...the basic requirement for maximum fatigue strength.

For longest life...highest fatigue strength, get the chains that give you ALL the *plus* values: Rex Roller Chains. Available in GLIDE-FIT (cottered) and DRIVE-FIT (riveted) styles. CHAIN Belt Company, 4619 W. Greenfield Ave., Milwaukee 1, Wis.

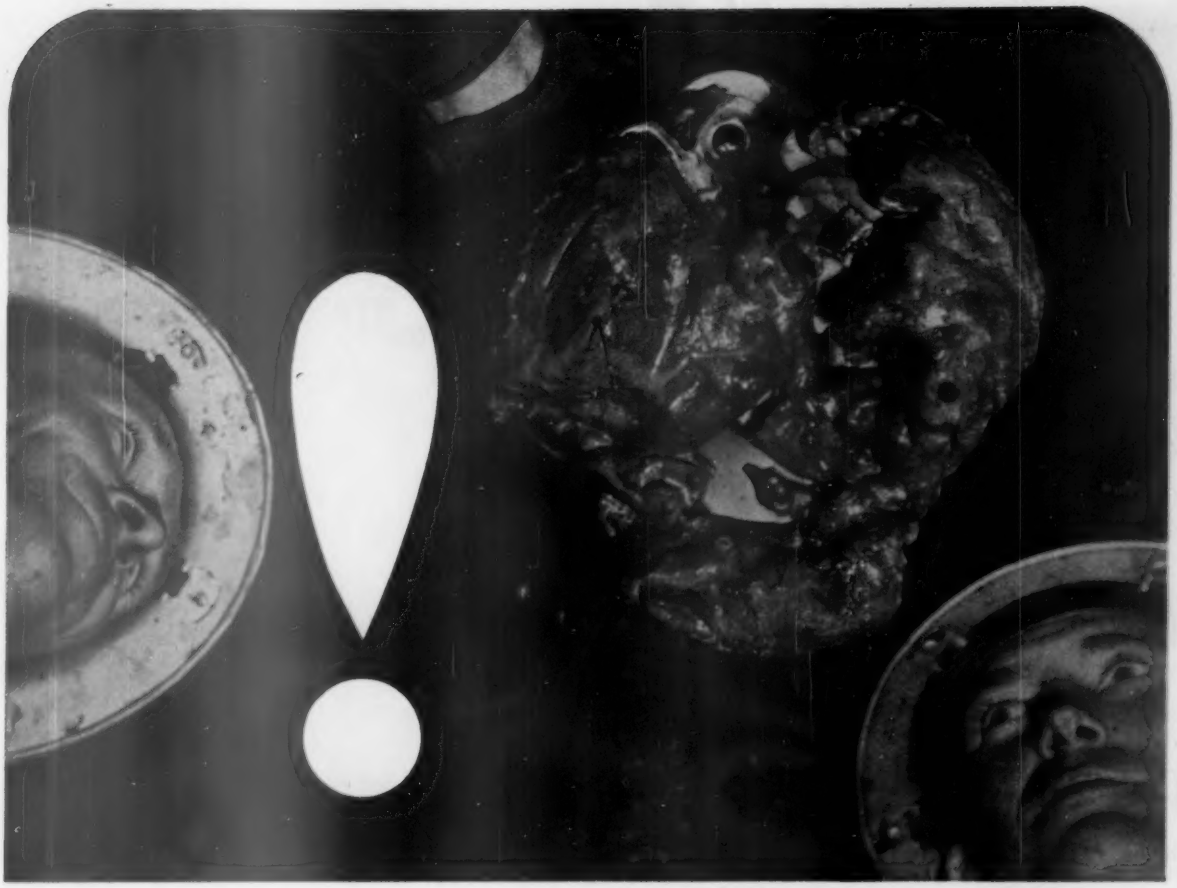
Get ALL the Plus Values

- Pitch control
- Guide-pierced and ball-swaged link plate holes
- Built-in beneficial stresses
- Positioned seam bushings
- Oil holes for effective lubrication
- Gap-free round rollers
- Roll pin fasteners...proved best

For Highest Fatigue Strength ...Longest Wear Life

REX® OIL FIELD ROLLER CHAINS

Oil Field Offices: Dallas • Houston • Los Angeles • Odessa • Oklahoma City • New York. Export Offices: Milwaukee • New York



Next time try a Baroid Mud Program

Baroid has reduced the element of chance and increased the element of success in *your* drilling mud program by integrating *every* step of production, distribution, and engineering application into a single chain of service. Oil companies and contractors who use this sensible plan know that such streamlining produces marketing efficiency.

When a single set of high standards are applied to every step, the end result is lower drilling costs and better completions. Baroid's mining, manufacturing, quality control, new-product research, warehousing, delivery and engineered application are maintained at the exacting level you expect.

Only through such coordination can uniform standards be extended from a local or regional level to one of national or international scope. In product quality, dependable delivery and engineering skill, you get Baroid excellence whether your well is near Coalinga or Casper; Corpus Christi or Crowley; Caracas or Calgary. *You save drilling dollars* with a Baroid Mud Program!

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BAROID DIVISION NATIONAL LEAD COMPANY

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5D4E

2 ways

Gates high capacity V-Belt Drives contribute to industry profits

ON EQUIPMENT OPERATING IN THE PLANT, Gates Super HC V-Belt Drives substantially lower maintenance costs—as on this centrifugal pump at Scott Paper Company's Detroit plant. This important pump was formerly driven by a special belt. In about 3 months, 6 of these special belts failed. In comparison, a Super HC Drive—capable of handling the 100-hp output for 24 hours a day under conditions of moisture and ambient temperature of 100° F.—has been operating for the past year with *no* down time and *no* replacement cost.

ON EQUIPMENT FOR SALE requiring multiple V-belt drives, Super HC V-Belts produce savings all down the line—as on these 8 x 6 Soft-Rubber-Lined Sand Pumps being readied for shipment in the final-assembly bay of Denver Equipment Company's Colorado Springs plant.

With Super HC V-Belt Drives, sheave dimensions can be reduced 30% to 50%, overall space up to 50% and drive weight by 20% and more. In addition, the cost of Super HC Drives is as much as 20% lower than drives previously used.

A little more than a year ago Gates introduced a new high capacity V-belt—a slimmer, tougher, more flexible V-belt with far greater capacity to transmit horsepower than conventional belts.

Because this revolutionary V-belt permits narrower sheaves, fewer belts, and closer center distances, hundreds of plants across the country have found Gates Super HC V-Belt Drives contribute to profits in 2 ways: through marked savings in drive costs on production machines *within* the plant and on powered equipment manufactured *for sale.*

Distributors of Gates V-Belts and Gates Field Engineers are listed in the Yellow Pages in all major industrial centers. Ask your distributor for the handbook, *The Modern Way to Design V-Belt Drives.*

TPA 534B

The Gates Rubber Company • Denver, Colorado

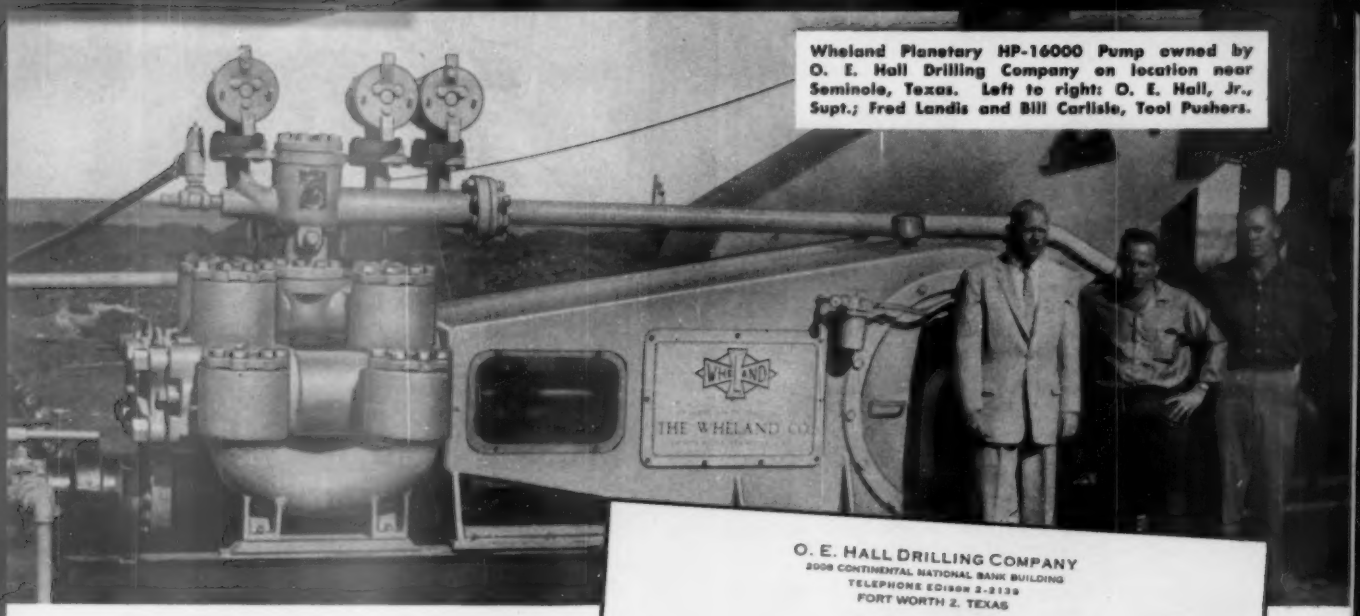
Gates Rubber of Canada Ltd., Brantford, Ontario

Gates *World's Largest Maker of V-Belts*

same hp capacity in smaller "package"

GATES SUPER HC V-BELT DRIVES

HIGH CAPACITY



Wheland Planetary HP-16000 Pump owned by O. E. Hall Drilling Company on location near Seminole, Texas. Left to right: O. E. Hall, Jr., Supt.; Fred Landis and Bill Carlisle, Tool Pushers.

"... the pump has improved our operation ... we will be happy to recommend it."

O. E. HALL, Jr.

O. E. HALL DRILLING COMPANY
2008 CONTINENTAL NATIONAL BANK BUILDING
TELEPHONE EDISON 2-2139
FORT WORTH 2, TEXAS

February 16, 1960

The Wheland Company
Signal Mountain Road
Chattanooga, Tennessee

Mr. Gordon L. Smith, Jr.
Manager Rotary Drilling Equipment Sales

Dear Mr. Smith:

We thought you would be interested to know how pleased we are with the performance of our Wheland Planetary HP-16000 Pump. It is the smoothest running pump we have seen. The big gear reduction makes possible such a small sheave and the pump pulls very easily. We are also impressed by the compactness of the gear cartridge and the smooth performance of the new circular crosshead. In the several wells we have drilled thus far the pump has improved our operation in terms of penetration rate and savings in bits. Also has exceeded our expectations.

All of these wells have been located in West Texas. We operate our rigs throughout the Permian Basin covering a depth range of 4, 500 feet to 12, 500 feet with modern equipment.

We want to commend The Wheland Company for stepping forward with this improved design in slush pumps, and we will be happy to recommend it.

Very truly yours,

O. E. HALL DRILLING COMPANY
O. E. Hall Jr.
O. E. Hall, Jr.
Midland, Texas

WHELAND PLANETARY HP-16000 PUMP

Duplex Power Slush Pump

7 ¾"x 16", 600 HP at 65 RPM

WHELAND

ROTARY DRILLING MACHINERY

THE WHELAND COMPANY

CHATTANOOGA, TENNESSEE, U.S.A.

DRAW WORKS • SLUSH PUMPS • ROTARIES
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EXPORT DISTRIBUTORS: LUCEY EXPORT CORPORATION—233 Broadway, New York 7, New York—Broad Street House, London, E. C. 2, England.

THE WHOLE PROFIT PICTURE

When you are drilling, all of your equipment, all of your effort, time and money, in fact, your whole profit picture is framed in one simple operation—rotating the bit on the bottom of the hole. Peak efficiency at this point should be your most important consideration. Weight on bit and mud pressure must be maintained at accurate levels to get the job done with safety and the greatest possible profit.

Four time-tested Cameron products working as a team can help you hold bit efficiency where it belongs—to bring you more hole for less money.

CAMERON MUD LINE PRESSURE GAUGES give exact readings to maintain the hole, produce extra cutting action, efficiently remove cuttings, keep a cooler bit and of course, retain formation pressures.

Ordinary Gauges don't last very long when the service is highly abrasive drilling mud under extreme pulsating pressure. But the self-contained mechanism of the Cameron Gauge with its unique dampening feature, gives steady readings, good visibility and extra long life.

Illuminated models, bronze models for off-shore use and specials are available for any specific requirement.

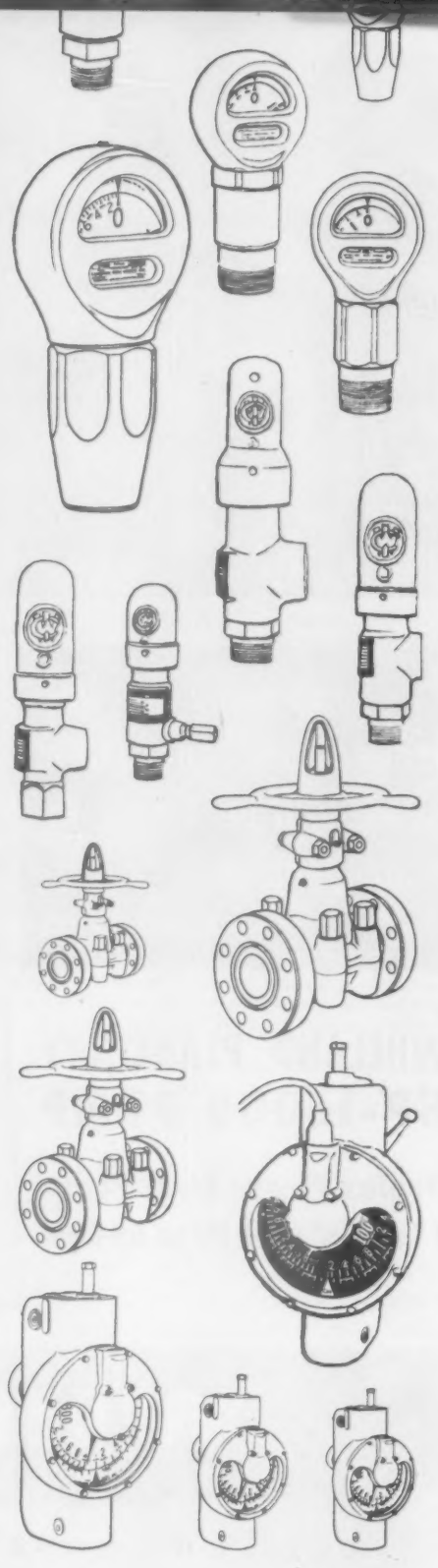
CAMERON SHEAR-RELIEF VALVES protect slush pumps, manifolds and other expensive equipment when overloads occur. These reliable safety valves can be set to any pressure relief. They shear a common nail (U.S. Standard) to give complete protection when destructive overloads threaten—may be re-set in a matter of moments. Any rig hand can choose the right nail with the handy hole chart on each shear-relief valve name plate.

CAMERON "FLEX-SEAL" MUD VALVES give the safest, most economical control of drilling mud—that's why they are the world's most popular mud valve.

Over twenty years after its introduction, the "Flex-Seal" is still the favorite of smart operators everywhere—the valve most often asked for in supply stores—the reason is simple—rugged dependability, long trouble-free service and easy repair.

CAMERON WEIGHT INDICATORS give you a straight-down hole in the fastest time with accurate indication of weight-on-bit. Since there is no hydraulic system temperature changes do not affect readings, there is no possibility of breakdown due to leakage. Like the Cameron Pressure Gauge, dampening of dial motion prevents damage from vibration.

When you are making hole, make the most of your rig time. Keep efficiency, safety and profits right up where they belong. Call your Cameron representative and let him show you the whole profit picture.



Cameron

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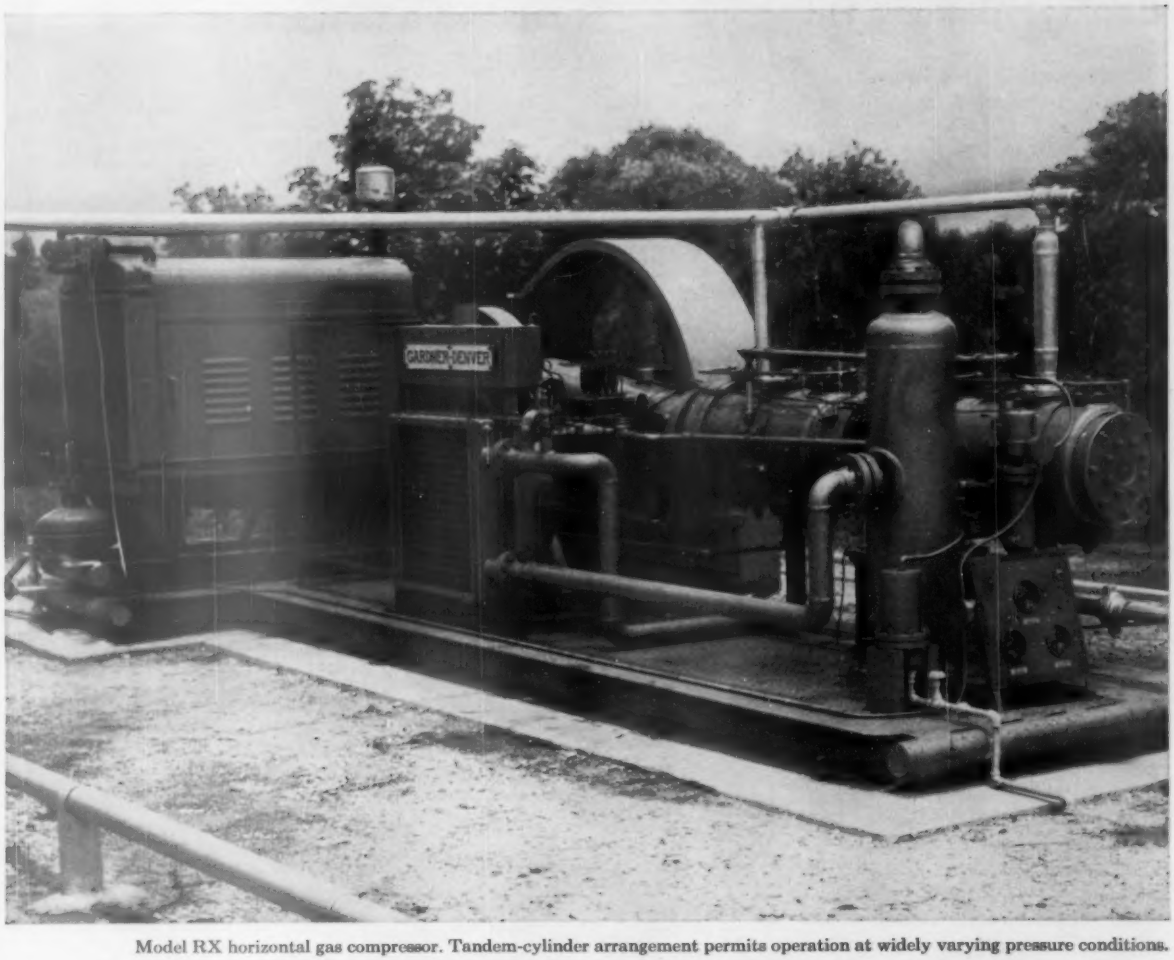
Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd., 76 Grosvenor St., London W. 1 England.

Engineered for the job from skid to scrubbers . . . Gardner-Denver gas compressors



Model RX horizontal gas compressor. Tandem-cylinder arrangement permits operation at widely varying pressure conditions.

Horizontal and vertical units

Single- and multi-stage models

Horsepower range from 5 to 330

Single responsibility

Gardner-Denver gas compressors are tailored to meet specific field conditions. All components are Gardner-Denver-engineered . . . are combined at our Dallas plant into a compact package ready for service. Ask your Gardner-Denver petroleum industry specialist for details.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

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They Say—

Booklet Makes a Hit

Dear Sir:

Congratulations on your new booklet "Why is Gasoline Such a Bargain?" (OGJ, Aug. 1, p. 138).

There is a real need to better inform the customers and stockholders of the industry as to oil prices and profits. Your booklet is most helpful, and I hope oil companies will give it wide distribution.

Minor S. Jameson, Jr.
Executive Vice President
Independent Petroleum
Association of America.

Dear Sir:

"Why Is Gasoline Such a Bargain?" is, in my opinion, one of the best presentations I have seen on this very important subject.

I think that your publication is to be congratulated for efforts such as this on behalf of the oil industry.

J. M. Shea, Jr.
Vice President
American Petrofina Co.
of Texas

Dear Sir:

I have just read your booklet, "Why Is Gasoline Such a Bargain?" and I want you to know that I think it is an excellent piece.

A. F. Lorton, Jr.
Gulf Oil Corp.
Houston

Dear Sir:

Our sincere congratulations to The Oil and Gas Journal for an excellent job in the preparation of the brochure on facts about oil.

We are hopeful that the oil companies will take advantage of the opportunity to get the oil industry's message across to our customers. I know of no better way than to see that the various service stations throughout the country are adequately supplied with copies of this booklet.

Paul D. Williams
Western Petroleum
Refiners Association
Tulsa.

Editor's note: Reprints of this booklet are available. Write Reader Service Department, Box 1260, Tulsa, for quantity order prices.

There must be a solution

Dear Sir:

I have read in the August 1 issue (p. 97) about the recent meeting here

the OIL AND GAS JOURNAL

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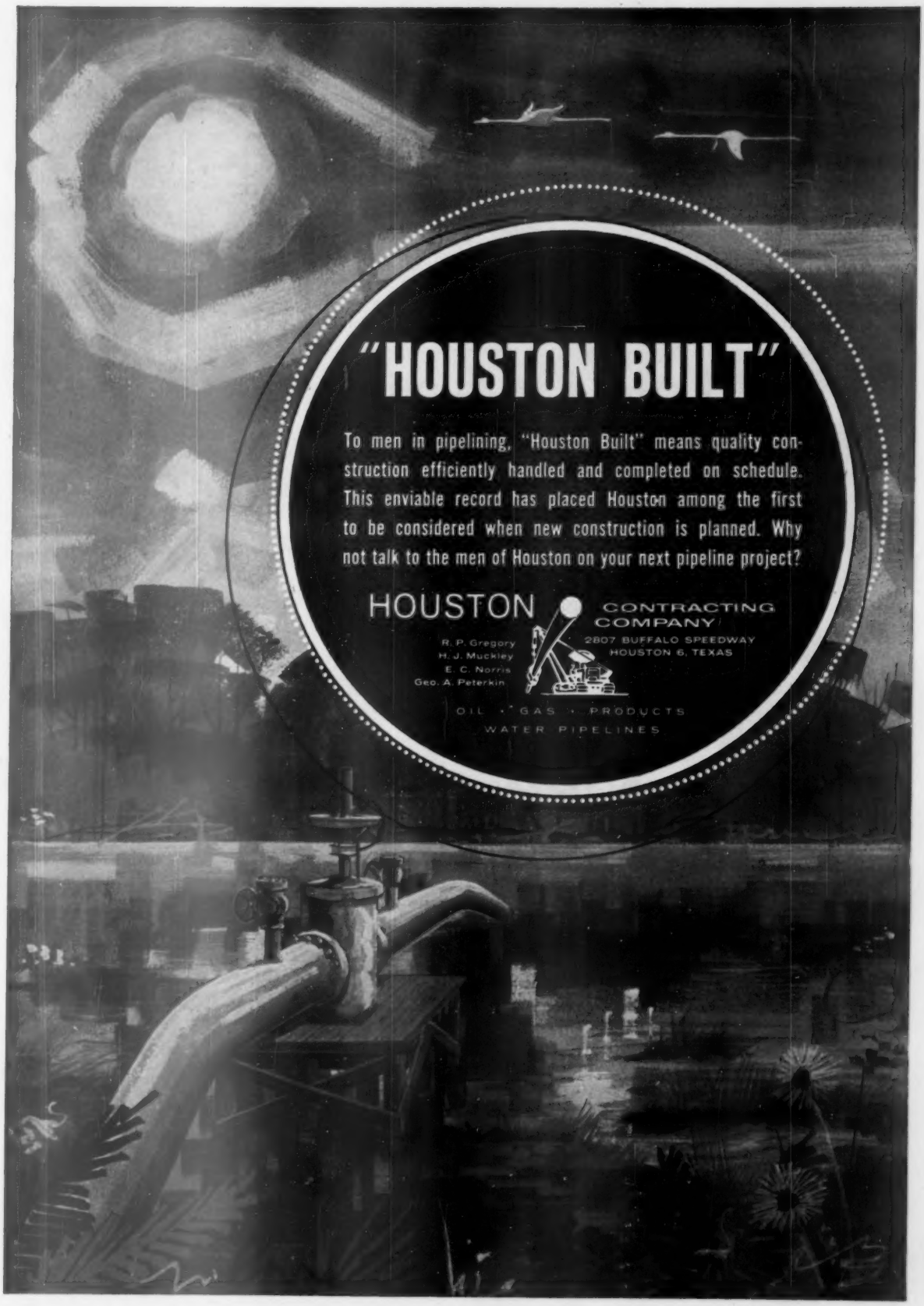
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To men in pipelining, "Houston Built" means quality construction efficiently handled and completed on schedule. This enviable record has placed Houston among the first to be considered when new construction is planned. Why not talk to the men of Houston on your next pipeline project?
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WATER PIPELINES

in Oklahoma about oil prices and pipeline charges now being discussed.

Your publication has considerable knowledge of business and I wonder if you might suggest a plan that would be of help under the circumstances.

Could there be a plan worked out wherein the producer would set aside a sum, say 10 or 15 cents a barrel, and organize some sort of cooperative and use the funds to buy out stock or interests in a large company having pipelines and refineries, or even trucking companies, or whatever may be necessary according to the situation?

Perhaps under a long term the oil producers would own sufficient stock that they might be represented in the management or directorate of some companies and thus have some say about the price and the way the charges to the producers are handled.

It is a difficult situation and individually the independent operator is helpless. Even when an operator installs larger tanks in a central location to handle oil from two or more leases, or if he unitizes the acreage, still he is penalized by the buyer, who gives no consideration to what the operator has done.

What I have written is just a thought. Your publication surely could come forth with a worthwhile solution that, while not satisfactory to everyone concerned, could be of considerable help in the present situation.

E. Phil Kirschner
Muskogee, Okla.

Adjusting to conservation

"It is not easy to change abruptly from a condition of relatively little regulation to a condition of complex regulation. That is true because people in the oil and gas industry, like those of all other industries, adjust slowly to new conditions.

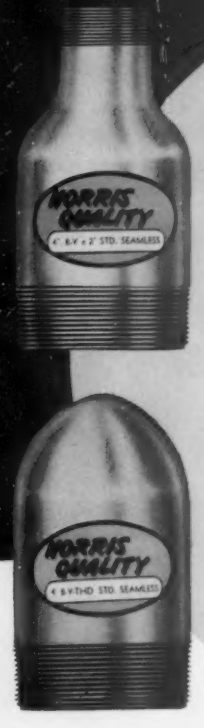
"We must frequently learn to crawl, then walk and even run. In certain states where new statutes have required drastic adjustment, the result has been serious antagonism to conservation legislation.

"The history of conservation indicates that it is more workable to allow industry to experience the benefits of the basic and fundamental elements of oil and gas conservation before adopting the more controversial elements."

John D. Knodell, Jr., Humble Oil & Refining Co., in a speech on the Kentucky Oil and Gas Conservation Act of 1960 before the eastern district meeting of API's Division of Production.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

Always at your Supply Store



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NIPPLES
and
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Safety . . . craftsmanship . . . durability . . . precision . . . yes, these elements are important in Swaged Nipples and Bull Plugs. And, these are the elements found in *all* W. C. Norris fittings — elements proven by the experience of our customers.

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CALENDAR

AUGUST

14-17 American Society of Mechanical Engineers, American Institute of Chemical Engineers, heat transfer conference and exhibit, Statler Hilton Hotel, Buffalo, N. Y.

14-19 National Congress of Petroleum Retailers, Inc., annual session, Shamrock-Hilton Hotel, Houston.

15-16 North Dakota Oil and Gas Association, annual meeting, Grand Pacific Hotel, Bismarck.

15-26 Sacramento State College, summer institute on nondestructive testing, Sacramento, Calif.

19 Southern Gas Association, roundtable conference on pipeline engineering, Mayo Hotel, Tulsa.

22-26 Gordon Research Conference, catalysis, Colby Junior College, New London, N. H.

26 Southern Gas Association, transmission management fall conference, Shamrock Hilton Hotel, Houston.

29-31 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

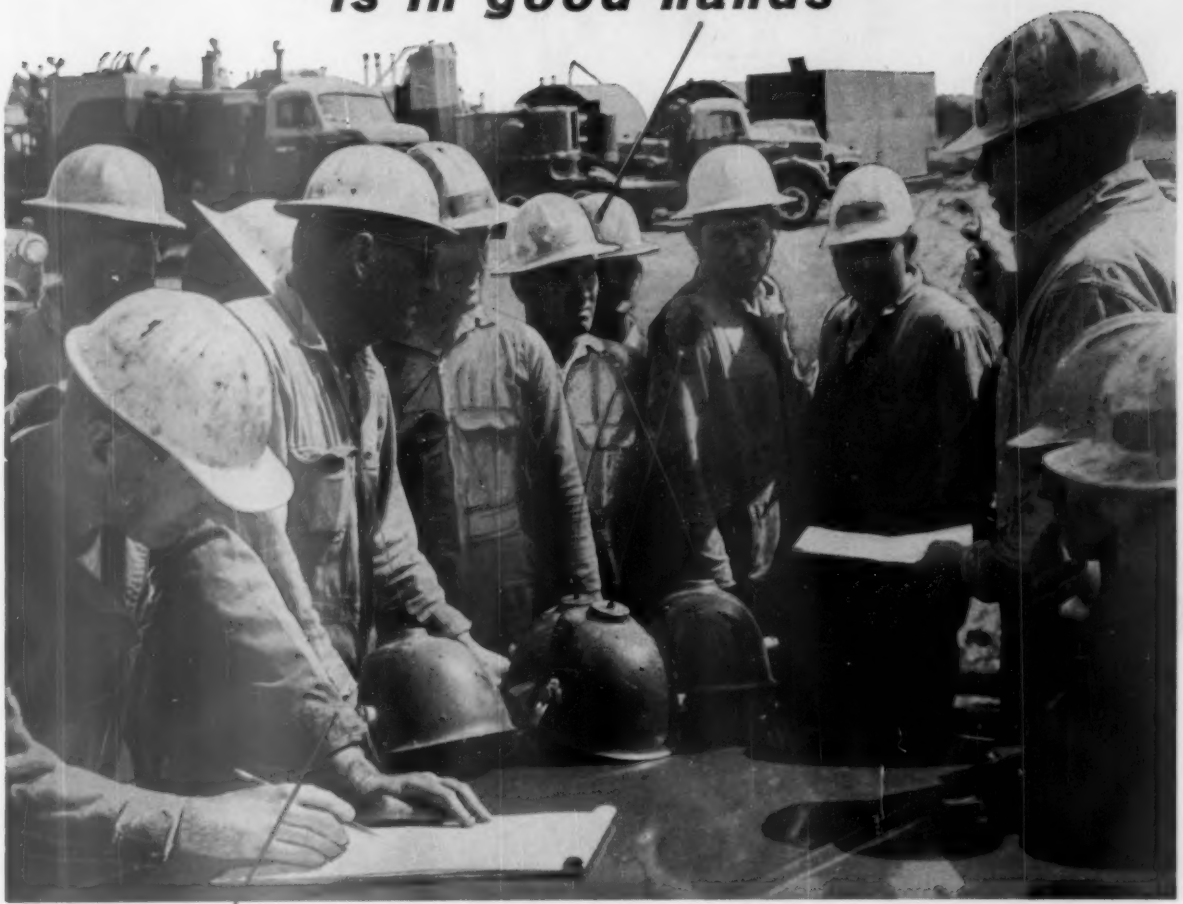
30-Sept. 2 American Association for the Advancement of Science, Alaska Division, eleventh Alaskan science conference, Anchorage.

SEPTEMBER

6-7 Chemical Institute of Canada, or-

YOUR FRACTURING JOB

is in good hands



with the HALLIBURTON TEAM

If you could hear what is being said in this session, you would get a complete briefing on a Halliburton fracturing job about to get underway. This helps *every* man to be fully aware of each phase of the job in general – and to be thoroughly prepared for his assignment in particular.

This standard pre-planning session is an important part of the careful on-the-spot coordination necessary during every phase of a fracturing job. From each Halliburton man on the team, you can count on a pair of watchful eyes, skillful hands – and a highly trained mind . . . working for you.

Feel the confidence of having this capable crew on your next fracturing treatment. Confer with your nearby Halliburton man – today!

WORLD'S LEADER IN FORMATION FRACTURING

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FRACTURING SERVICES

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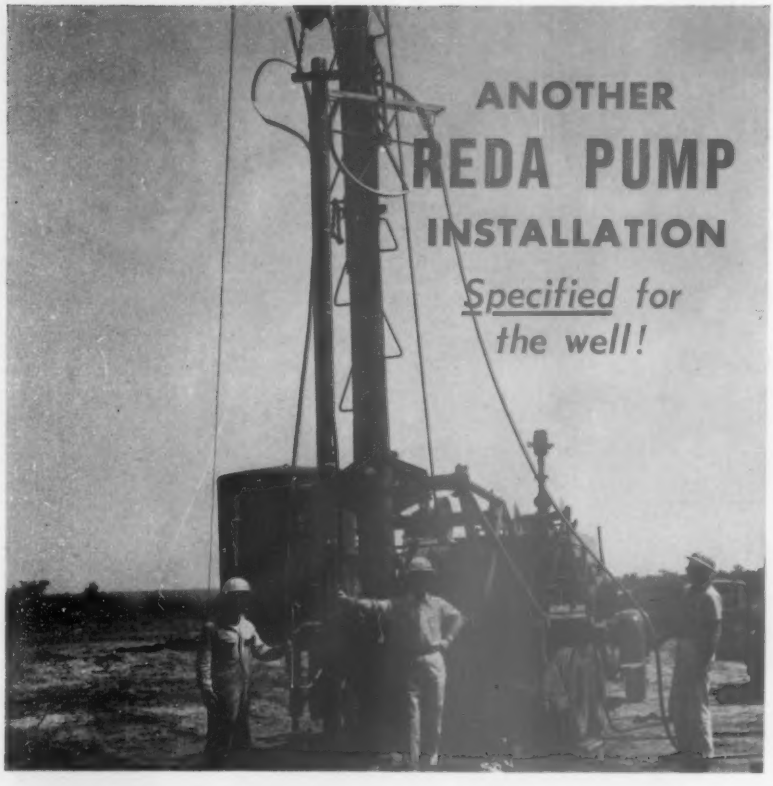
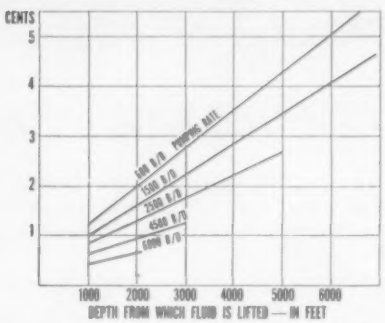


REDA Does the Job Better and at LOWER COST

Billions of barrels of fluid (oil and water) have been produced at an average lifting cost of less than one cent per barrel for each 1,000 foot lift. Chart "A" illustrates average lifting cost from 600 B/D to 6,000 B/D using Reda Submergible Pumps.

Most complete submergible pump line for producing oil wells, water supply wells, brine wells, etc. Sizes range from 5 to over 240 h.p. . . . models for wells cased with 4", 5½", 6⅝", 7" or 9⅝" casing . . . for depths from 500 to 10,000 feet, and for capacities of 100 bbl. to over 18,000 bbl. per day.

AVERAGE LIFTING COST* per barrel of fluid



*Included: Electric Energy (10 Mills Per KWH), Run and Pull, Repairs, Upkeep, Transportation, Labor and Amortization (8 Yrs.)

Chart "A"

Write for Descriptive Folder R-686 Today

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Manufacturers of Submergible Electric Motors & Pumps for over 40 years
Pumps for Oil, Brine, Water, Gasoline, Jet Fuel, Chemicals, LPG

SIGN OF QUALITY SUBMERGIBLE REDA PUMPS

ganic chemistry division conference, Edmonton.

7-9 American Society of Mechanical Engineers, joint automatic control conference, Massachusetts Institute of Technology, Cambridge, Mass.

7-10 Billings Geological Society, annual field trip, Hebgen Lake-Madison Valley area of southwestern Montana.

8-9 National Research Council, Chemical Institute of Canada, tenth Canadian high polymer forum, Alpine Inn, Montreal.

8-9 Mid-Continent Oil and Gas Association, Louisiana - Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

8-10 Chemical Institute of Canada, western regional conference, Regina.

8-10 Intermountain Association of Petroleum Geologists and Eastern Nevada Geological Society, field trip, economic geology of east-central Nevada.

11-13 New Mexico Petroleum Industries Committee, annual convention, Western Skies Hotel, Albuquerque.

11-16 American Chemical Society, national meeting, New York City.

14-15 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

14-16 National Industrial Conference Board, eighth annual marketing conference, Waldorf-Astoria Hotel, New York.

14-16 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

15 Natural Gasoline Association of America, Rocky Mountain regional meeting, Palliser Hotel, Calgary.

15-16 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual engineering management conference, Morrison Hotel, Chicago.

16-17 Kansas Geological Society, twenty-fifth annual field conference, northeastern Oklahoma, Western Hills Lodge, Wagoner, Okla.

18-21 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Jung Hotel, New Orleans.

19-21 Texas Mid-Continent Oil and Gas Association, annual meeting, Granada Hotel, San Antonio, Tex.

20-21 Illinois oil industry convention, sponsored by Illinois Oil and Gas Association, Illinois Oil Council, Illinois Petroleum Marketers Association, and Chicago Gasoline Jobbers Association, St. Nicholas Hotel, Springfield.

20-21 Ohio Petroleum Marketers Association, fall conference, Netherland-Hilton Hotel, Cincinnati.

21 American Petroleum Institute, Coalinga-Kettleman chapter, annual barbecue and golf tournament, Polvadero Country Club.

21-23 Pacific Coast Gas Association, annual meeting, Westward Ho Hotel, Phoenix.

25-27 American Association of Oilwell Drilling Contractors, annual meeting, Roosevelt Hotel, New Orleans.

25-28 American Institute of Chemical Engineers, meeting, Mayo Hotel, Tulsa.

25-28 American Institute of Electrical Engineers, petroleum industry committee, electrical conference of the petroleum industry, Hotel Skirvin, Oklahoma City.

26-29 American Welding Society, fall meeting, Penn-Sheraton Hotel, Pittsburgh.

26-30 Instrument Society of America, in-

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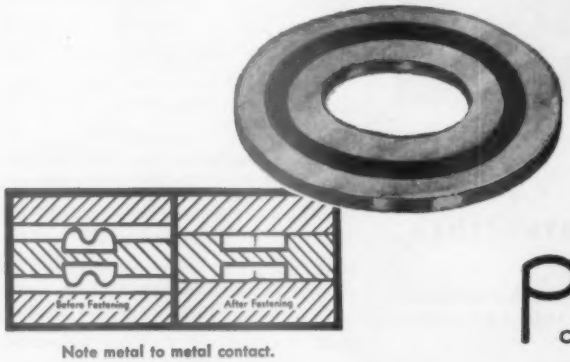

Note metal to metal contact.

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strument-automation conference and exhibit, and fifteenth annual meeting, Coliseum, New York.

27-29 Mid-West Gas Association, annual school and conference, Memorial Union, Iowa State College, Ames.

29-30 Mid-Continent Oil and Gas Association, Mississippi-Alabama division meeting, Grand Hotel, Point Clear, Ala.

29-Oct. 1 West Texas Geological Society, field trip, Delaware Basin of West Texas and southeast New Mexico.

OCTOBER

2-5 Society of Petroleum Engineers of AIME, annual fall meeting, Denver.

3-4 Independent Natural Gas Association of America, annual meeting, Fontainebleau Hotel, Miami Beach.

4-5 University of Kansas, gas-measurement institute, National Guard Armory, Liberal, Kans.

5 Society of Plastics Engineers, Inc., regional technical conference, Mark Hopkins Hotel, San Francisco.

6-7 National Association of Corrosion Engineers, annual western region conference, Sheraton-Palace Hotel, San Francisco.

6-8 National Association of Corrosion Engineers, southeast region conference, Dinkler-Plaza Hotel, Atlanta, Ga.

6-8 National Academy of Sciences, National Research Council. ninth national clay conference, Purdue University, Lafayette, Ind.

10-12 American Gas Association, annual convention, Atlantic City.

11-14 National Association of Corrosion Engineers, northeast region conference, Prichard Hotel, Huntington, W. Va.

12-14 Southwestern Federation of Geological Societies, annual meeting, Wooten Hotel, Abilene, Tex.

13-14 California Natural Gasoline Association, annual fall meeting, Hotel Miramar, Santa Monica, Calif.

13-16 Taft, Calif., Oildorado, fiftieth anniversary celebration.

14-15 University of Texas, E. P. Schoch lecture series on rate processes, Batts Hall Auditorium, Austin.

14-16 New Mexico Geological Society, annual field conference, Chama basin of northern New Mexico, registration, Taos, Oct. 13.

17-19 American Society of Mechanical Engineers, American Society of Lubrication Engineers, lubrication conference, Statler Hilton Hotel, Boston.

17-19 University of Minnesota, Pennsylvania State University, Colorado School of Mines, biannual symposium on drilling and blasting, Golden, Colo.

19-20 National Association of Corrosion Engineers, north central region conference, Schroeder Hotel, Milwaukee.

19-21 Gulf Coast Association of Geological Societies, convention, Biloxi, Miss.

19-21 Rocky Mountain Oil and Gas Association, annual convention, Brown Palace Hotel, Denver.

20-21 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

20-23 Odessa Oil Show, Odessa, Tex.

23-25 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

24-25 American Society of Mechanical Engineers, American Institute of Electrical Engineers, fuels conference, Daniel Boone Hotel, Charleston, W. Va.

25-28 National Association of Corrosion Engineers, south central region conference, Mayo Hotel, Tulsa.

26-27 Armour Research Foundation of Illinois Institute of Technology, computer applications symposium, Morrison Hotel, Chicago.

26-27 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

28 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

NOVEMBER

3-4 American Association of Petroleum Geologists, Pacific section, annual meeting, Ambassador Hotel, Los Angeles.

3-4 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.

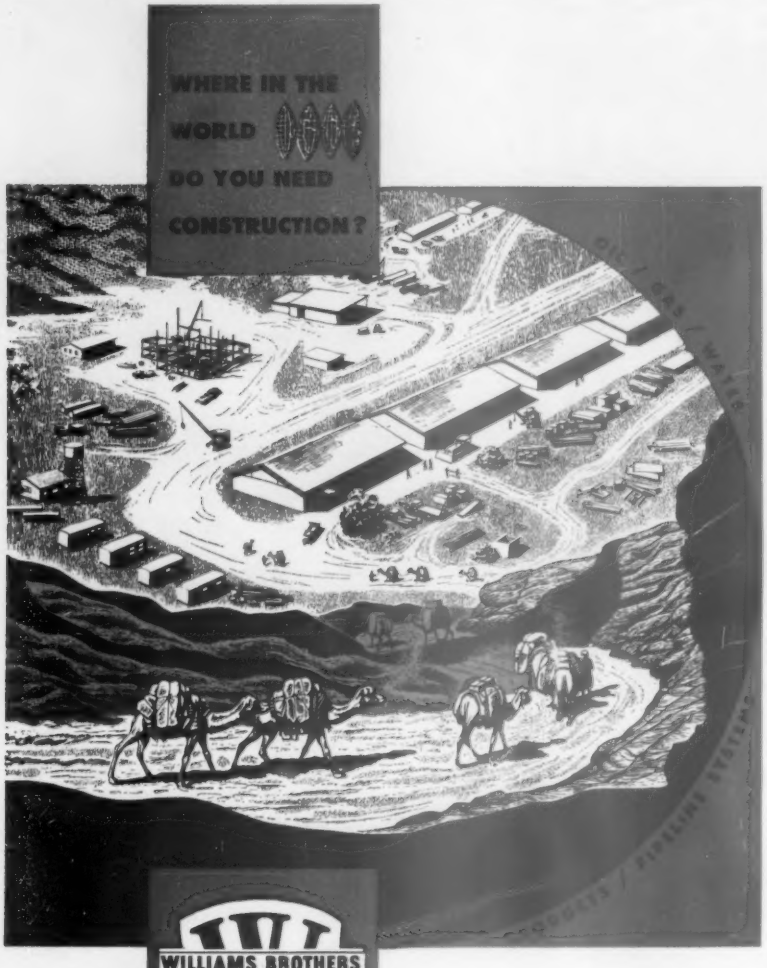
6-9 Chemical Institute of Canada, chemical engineering division, conference, Quebec City.

7-10 Society of Exploration Geophysicists, international meeting, Moody Convention Center, Galveston, Tex.

14-16 American Petroleum Institute, fortieth annual meeting, Conrad Hilton, Palmer House and Congress hotels, Chicago.

14-16 Society of Petroleum Engineers of AIME, Venezuelan sections, fourth annual meeting, Maracaibo, Venezuela.

15-16 University of Kansas, natural-gas pipeline institute, Courthouse, Liberal, Kans.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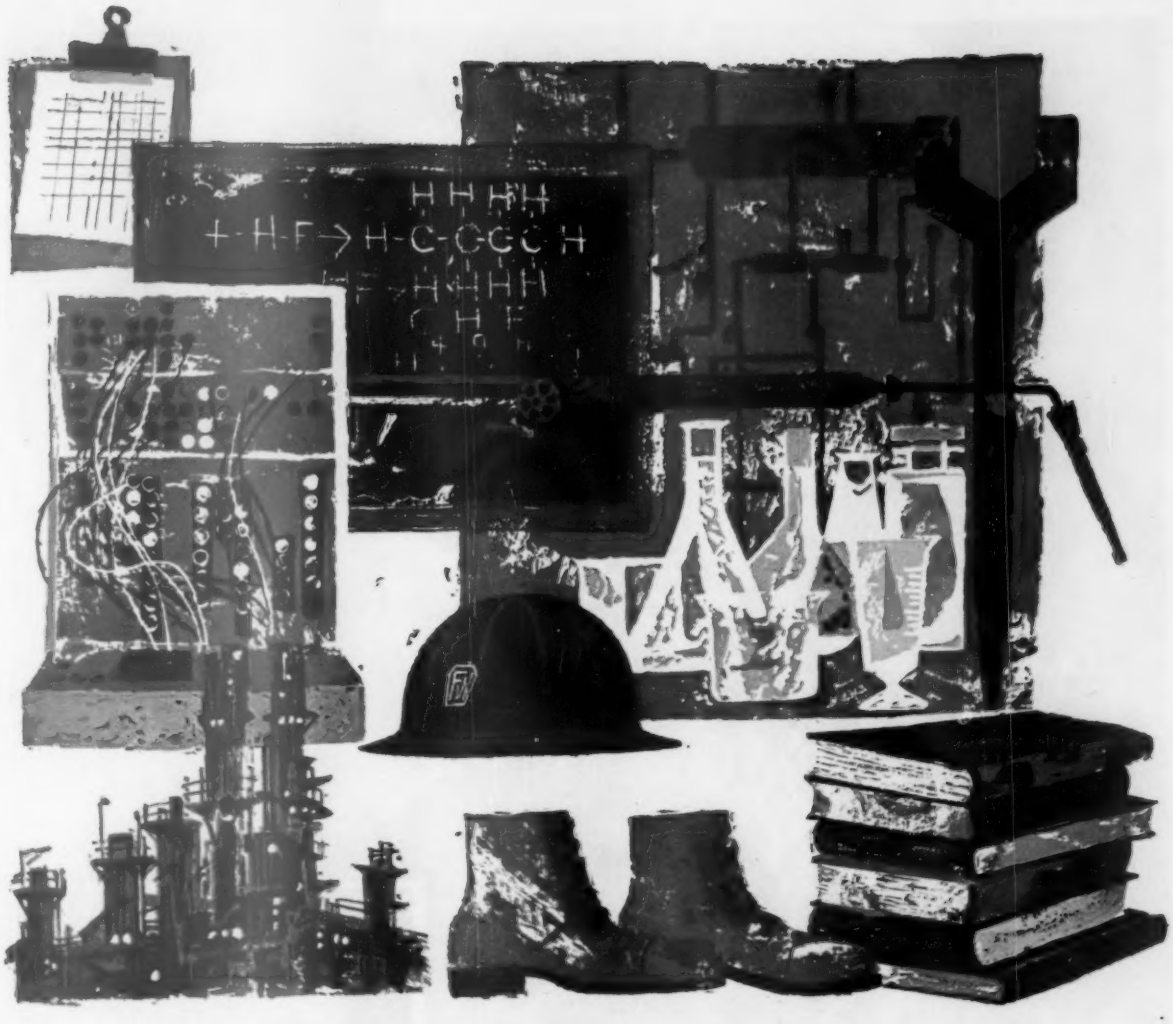

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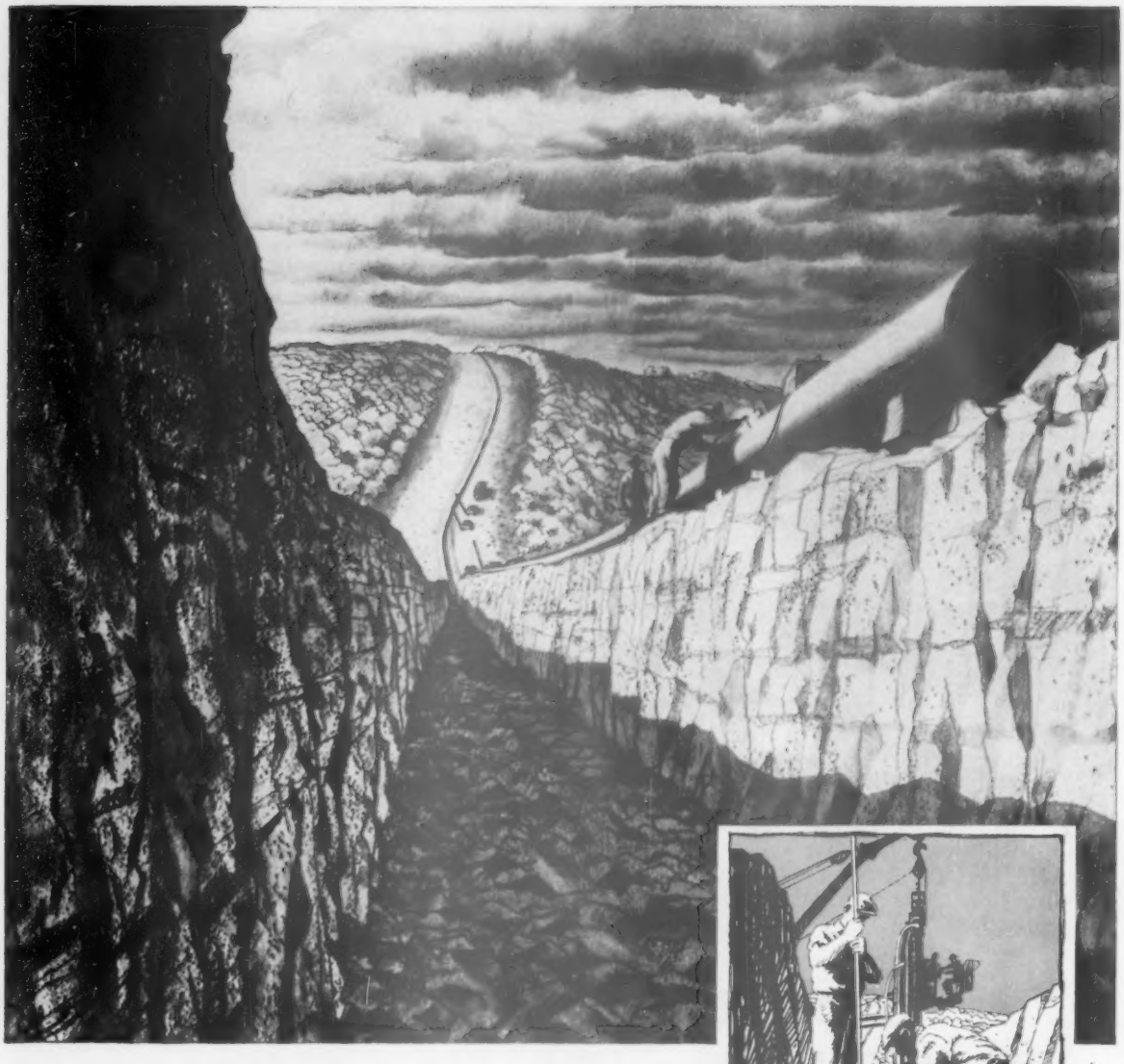

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50 years ago

August 18, 1910

Newly organized Central Fuel Oil Co. closes long-standing mystery deal involving purchase of producing properties totaling 20,000 acres spread over the Cherokee and Osage districts of Osage, Washington, and Nowata counties, in Oklahoma. More than 20 individuals and independent company ownerships receive $1,250,000 initial payment on $5,100,000 transaction. Daily oil production totals 6,000 bbl.

Scarcity of lumber in some parts of the country is bringing steel derricks into use. Most of the steel derricks beginning to appear on the market preserve the fundamental principles of the wooden rig, but it is possible to buy an outfit built entirely of steel.

25 years ago

August 15, 1935

A gusher discovery at Rodessa (Rodessa field), north of Shreveport, in northwestern Louisiana, opens the first commercial oil production from the deep Trinity formation, and triggers a new lease and exploratory play along a possible 100-mile trend extending northeastward into southern Arkansas, and southwestward into eastern Texas. United Gas Public Service Co.'s 1 Young discovery well is completed with potential flow of 6,600 bbl. daily from the Glen Rose (Trinity) horizon at total depth of 6,048 ft.

Three-judge federal court at New Orleans hands down decision in Clymore Production Co.'s Agua Dulce case upholding Texas' recently enacted gas law and the validity of Texas Railroad Commission's orders regulating production of natural gas.

10 years ago

August 17, 1950

Shell Oil Co. completes its 2 Weeks Gall-State Unit at Weeks Island field, in Iberia Parish, Louisiana Gulf Coast, as the deepest oil producer east of the Rocky Mountains, and the second-deepest in the world. The well flowed 538 bbl. of 30°-gravity crude daily through 13/64-in. choke from sand at 15,127-37 ft. The world's deepest producer still is Standard Oil Co. of California's 5 Mushrush, in Wasco field, Kern County, California. It was completed in 1949 at 15,250-530 ft.

The first man-made underground-storage reservoir for propane and butane is placed in operation at the Sid Richardson gasoline plant in Keystone field, near Kermit, in Winkler County, West Texas. Initial reservoir, leached out of thick salt bed 2,000 ft. below surface, has storage capacity for 7,500 bbl.

JOURNALLY SPEAKING

200,000 Rock Hounds

OUR STAFFERS who worked on this Canadian issue report that the two most interesting things they found in Canada this year were the number of helicopters used by the oil industry and the number of geologists looking for jobs.

There could be some cause-and-effect relationship here. What with aerial photography, airborne magnetometers, and fast communication by airplane, a survey might come up with some such statistic as that one geologist in a helicopter can do the work formerly done by three and seven-tenths geologists afoot or on horseback.

But some people say that it is only that "seven-tenths geologist" who is out of a job—meaning that the real, honest-to-John geologists don't need to worry about their meal tickets and that the payroll purges are hitting largely the deadwood, the misfits, and those who lack a natural-born nose for oil that enables some men to smell a discovery before the first wildcat is staked.

They (and we guess this means those geologists who still are eating regularly) say that this weeding-out process is going to make the profession stronger, better, and more prestigious. Maybe so, but that's small comfort to those unemployed geologists just standing on the corner watching all the helicopters go by.

In contrast, we get astonishing geologic intelligence from Red China (via the publication of the minerals branch of the AIME). That country has gone rock-hound crazy.

The article says that there are 12,000 geologists in the Chinese Ministry of Geology, in addition to 11,000 technicians. A total of 270,000 employes are on the geological service roster. There are 14,000 geology students in 10 educational institutions, with 18,000 others in technicums (whatever technicums is or are).

Of course, there are two possible explanations for that. One is that Red China's boasted "Giant Step Forward" from feudalism to industrialization is actually clicking and is developing a need for enormous discoveries of oil, gas, coal, ore, and minerals. The other is that such payroll padding is typical of government bureaucracy, particularly the communist variety, and that 100,000 bureaucrat geologists won't find as much oil as 1,000 competitive, free-enterprise geologists would find.

But, not content with its formidable stable of staff geologists, the Chinese government is augmenting its exploratory effort with amateurs. In what was doubtless labeled a people's democratic patriotic volunteer movement, 200,000 ordinary citizens were mustered in one province alone, commissioned as rock hounds overnight, and sent scampering through the hills and vales to ferret out Mother Earth's hidden treasures.

The report is that these 200,000 prospectors turned up 2,000 occurrences of valuable minerals. But there's a catch to this. Only about 5% of these "discoveries" could be checked out as valid by the professionals who followed up on this glorified Easter-egg hunt.

In fact, articles from the Chinese technical press (government-controlled, of course) give hints that there is something of a schism between the professional and the amateur divisions of Red China's high-pressure exploration campaign. It appears that the professional geologists are prone to look down their noses at the geological theories, exploration methods, and discovery evidences fancied by the amateurs. For this they are being chided for lack of enthusiasm for the people's democratic republic and are even being accused of such heinous crimes as "dogmatism," "conservatism," and "rightism."

Any U. S. or Canadian geologist who has had to deal with doodlebuggers, wand witchers, dream interpreters, and fiery-eyed mystics who can "feel" oil in their bones will sympathize with the troubles of the 12,000 Chinese geologists in dealing with the 200,000 fervent amateur rock hounds. We can see how it would take 270,000 employes in the geology bureau to handle such problems.

There's a lot to be said for the theory of multiple effort in exploration success, but we'll wager that a couple of dozen helicopters equipped with "rightist" geologists are more effective than 200,000 coolies-turned-rock-hound on a patriotic outing in the hills.

—Henry D. Ralph

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This crude-price cut could be felt around the world

THE CUT in Persian Gulf crude prices may be small in cents and remote in miles, but it is of great significance to the United States and the rest of the world.

It signals the arrival of the long-heralded new era in world oil-price structures caused by a surplus of crude capacity and the entry into world markets of many new producing and distributing entities.

It shows that the present condition of price discounting and market maneuvering is not transitory but must be grappled with openly.

DISCOUNTS FROM POSTED PRICES have been widespread, so in a sense the cut is only belated recognition of prevailing conditions.

But the action unhinges the entire world price structure because crude postings are a traditional benchmark for the industry. Royalties, taxes, and product prices are commonly computed from them. They are the one stable point of reference in a fluid market.

Russian price competition, particularly in India, triggered the cut. But Russia's export volume is not—yet—big enough to swing world prices. The real cause is that the half-dozen historic international companies are no longer able to control world crude prices in the face of competition from a multiplicity of exporters.

This is the final break in the tie of world oil prices to U. S. Gulf-Caribbean quotations. It means that the Eastern Hemisphere will now set its own price structure and that the Persian Gulf is now the center of gravity of the world's oil economics as well as of its crude reserves.

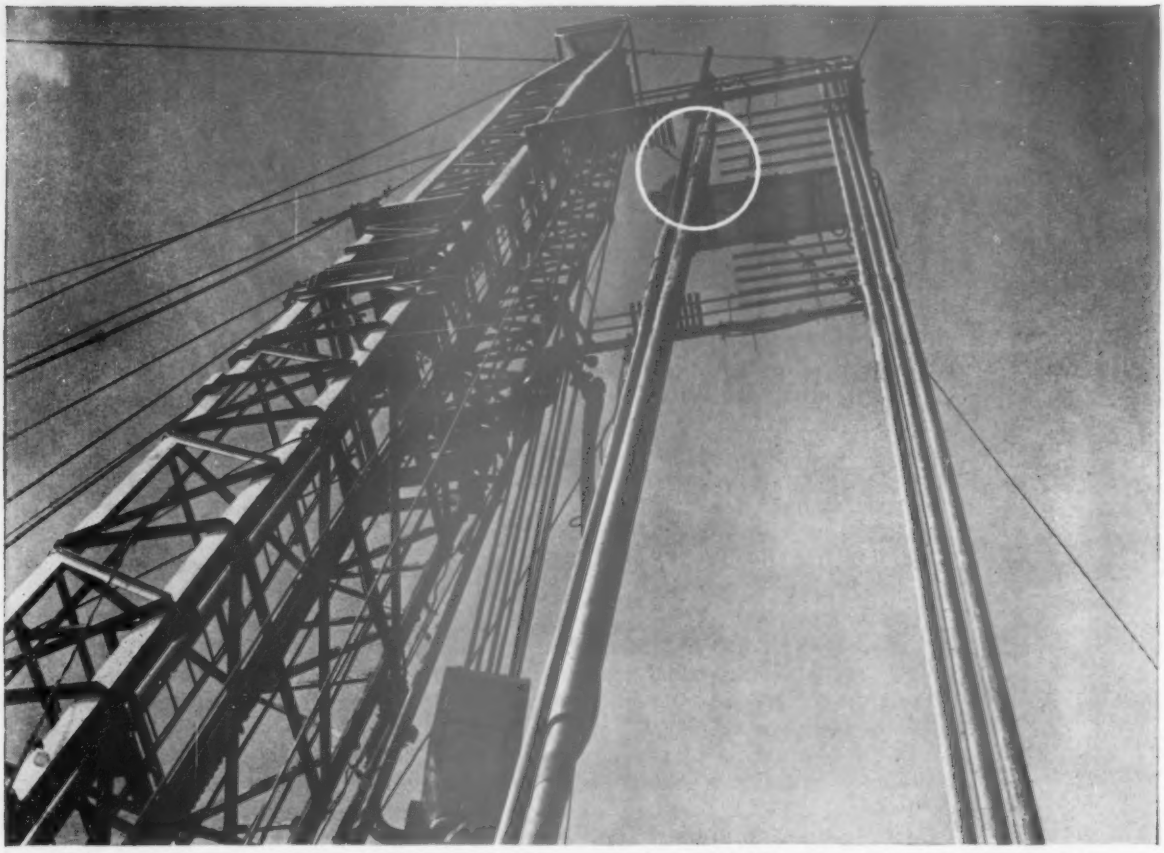
Will the cut be felt west of Suez? It is hard to see how it will not, sooner or later. With buyers looking for bargains, and ample supplies available in many places, world oil prices would seem to be very definitely headed downward. If they go way down, there will be widespread ramifications.

DEFENSIVE ACTION by producing countries will encounter serious economic and political difficulties. The big exporting nations are themselves partly to blame for the situation by encouraging more production and new exporters.

Venezuela's move to prohibit sales at cut prices could lose her much of her export market. And Middle East nations are scarcely in position to bolster Venezuela with effective cooperation—unless they quickly form an international agreement to prorate production.

Canada may find low-priced foreign crude pushing farther westward against domestic crude, thus spurring producers' demands for protection.

And the United States may find that it is not as thoroughly insulated against the foreign oil surplus as it supposed. Import quotas will be more highly prized; domestic crude prices will look high by comparison; and this could bring on a battle between producers seeking more protection and consumer interests seeking the benefits of low world prices.



Work-over rig in field near Houston, Texas, with Wilson pulling tool in place to pull old liner. Type 4340 nickel alloy steel insures long trouble-free life for piston head and rod assembly in this 40-foot-long tool. Note anchor section at top. Hold down slips (three visible) are hard-wearing AISI 4620 nickel alloy steel.

Going fishing?

4340 and 4620 nickel alloy steels provide safe 300-ton pulling power

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Pulling tool protects rig; nickel alloy steel protects puller

Since the pulling tool and not the rig takes the whole brunt of the pull, its integral piston head and rod assembly must be extremely strong and resistant to hard wear and impact. What's more, they must be finish machined *after* hardening. Altogether, a difficult combination of properties to achieve, especially in the sections used!

To meet these requirements, Wilson Supply Company uses AISI 4340 nickel-chromium-molybdenum steel. With this steel, strength, hardness and impact resistance are obtained even in large sections that compare favorably with those secured in small sizes with other steels. Furthermore, machinability is good at hardnesses of 360 BHN and higher.

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Discounts Break Middle East Prices

• Jersey says a cut was inevitable since posted prices were no longer realistic, and Russia's move to grab more of the world market was partly to blame. Venezuela's Perez Alfonzo, fearing cut may spread his way, threatens to shut in any production sold at "unacceptable discounts."

Paul Swain
International Editor

THEY WEREN'T happy about it, but the Middle East's oil producing countries last week started sharing the cost of discount sales of crude.

The first crack in the Arab world's price structure in more than a year came when Esso Export Corp. cut its posted prices for all Middle East crudes. Only a little more than 10% of the Middle East's daily output of 5 million barrels is involved in the Esso move, but other companies operating in the same competitive markets are expected to follow.

Two days after the Esso announcement, British Petroleum Trading, Ltd., cut product-price postings at Abadan, but made no cut in Middle East crude prices. This was the only action by any other companies up to that time.

Venezuela immediately started taking governmental steps to try and prevent the price cut from spreading to the Western Hemisphere.

Esso Export, which handles Middle East oil sales for the Jersey Standard interests, cut its postings from 4 cents a barrel for relatively heavy Arabian Safaniya crude to 14 cents for lighter grades from Saudi Arabia and Iraq.

The price cut means a sizable loss of revenue for governments in the Middle East and, in effect, shifts a part of the burden of discount oil sales to the governments. Companies have been absorbing the discounts in a competitive market up to now.

Esso Export said the price cuts were made because posted prices for the world's biggest oil producing region are no longer realistic. The company said also that the Russians have accentuated the downward pressure on the price of oil by "new and widespread offers of Russian oil at low prices."

Esso Export's New Middle East Postings

Crude	Port	Gravity	Old Price (per bbl.)	New Price (per bbl.)	Reduction (per bbl.)
Safaniya	Ras Tanura	27.0-27.9	$1.50	$1.46	$.04
Kuwait	Mina Al Ahmadi	31.0-31.9	1.67	1.58	.09
Kirkuk	Banias	36.0-36.9	2.31	2.17	.14
Mosul-Kirkuk	Tripoli	35.0-35.9	2.29	2.15	.14
Bai Hassan-Jambur Heavy	Tripoli	34.0-34.9	2.17	2.03	.14
Basrah	Fao	35.0-35.9	1.80	1.68	.12
Iranian Heavy	Abadan	31.0-31.9	1.62	1.56	.06
Iranian Heavy	Kharg Island	31.0-31.9	1.67	1.61	.06
Iranian	Abadan	34.0-34.9	1.81	1.69	.12
Iranian	Bandar Mashur	34.0-34.9	1.86	1.74	.12
Stabilized Arabian	Sidon	34.0-34.9	2.27	2.13	.14
Stabilized Arabian	Ras Tanura	34.0-34.9	1.90	1.76	.14
Qatar	Umm Said	41.0-41.9	2.05	1.91	.14

E. G. Lindroth, senior vice president for finance and a director of Esso Export, said the price cuts would have come anyway, but Soviet oil is a factor.

The cuts were made, Lindroth said, because of "competitive offers and sales made at sizable discounts below posted prices by major suppliers."

"Discount sales have now become so prevalent that they can no longer be considered short-term marginal sales," Esso said. The company added that its study of the market indicates discounts are being granted for large and increasing volumes of oil and the amount and duration of discounted sale contracts is increasing along with the size of the discount.

At the same time Esso revealed new product prices at both Ras Tanura and Abadan. These included a reduction of half a cent a gallon for 90 RON and 83 RON gasoline and kerosine, and 0.6 cents for gas-oil and heating oil. The Bunker C price at Ras Tanura was cut 15 cents a barrel, but only 13 cents at Abadan.

The reaction . . . The reaction from both Arabs and Venezuelans was swift and will certainly increase if the price cut sticks.

In the United States after an extended visit in Venezuela, Mohamed Salman, petroleum affairs director for the Arab League, scoffed at the idea that Soviet oil is responsible for the move. If this is true he contended western governments subsidize the price of Arab oil to combat the Russions in the oil markets of the world (See related story on p. 85).

Dr. Juan Pablo Perez Alfonzo, Venezuela's minister of mines and hydrocarbons, moved swiftly in an attempt to head off any similar price cuts in his country. He threatened to cut off any Venezuelan production sold "under unacceptable dis-

counts." "The present change in posted prices will not be acceptable in Venezuela," he said flatly.

Shaikh Abdullah Tariki, influential head of Saudi Arabia's oil affairs, still complains bitterly about the 18-cent cut in posted prices a year ago in February. He complains almost as much about the fact that it was done without consulting the involved governments.

Tariki says that last price cut cost Saudi Arabia $34 million in revenue. On that basis the new cut will cost his country more than $25 million.

This newest price cut is certain to add fuel to Arab efforts to bring about more cooperation between the Middle East's oil producing countries and closer liaison between that region and Venezuela. The second annual Arab Petroleum Congress meets in Beirut in October and oil prices and the profit split between companies and governments are certain to be high on the agenda.

One of the aims of the congress is to establish an over-all oil policy endorsed by all the Arab producing nations. One important part of such a policy would be that no producing country would allow its prices to be cut without first consulting the other producers.

Salman's recent visit to Venezuela was for the purpose of discussing closer cooperation between the two oil exporting regions and to invite Venezuela officially to attend the Arab oil meeting.

Effect on Venezuela . . . It was still too early last week to determine exactly what the effect of the Middle East price cut will have on Venezuela or just how effective Dr. Perez Alfonzo's efforts to keep it from spreading to his country will be.

In the past any price cut in either area has eventually had an effect on the other. The February 1959 cut of 18 cents a barrel in the Middle East was followed by corresponding cuts in Venezuelan prices within less than 60 days.

Unlike the Arab producing countries, Venezuela's oil income is not directly linked to the posted price of crude. Venezuela taxes the profits of its operating oil companies. In the Middle East, the companies and the governments divide profits equally but the division is based on the posted price for the oil whether the companies actually sell it for that amount.

The Venezuelan minister, who only a few days earlier predicted that the price cut would come, will undoubtedly use all the power at his disposal to try and forestall any erosion in Venezuelan prices. He operates on the theory that he has the power to take any action necessary to safeguard the Venezuelan oil industry.

Venezuela's Perez Alfonzo
. . . he saw a price cut coming.

Just a week ago, Perez Alfonzo announced in Caracas that he had "forbidden" two oil companies to sell Venezuelan oil at a discount.

The minister did not publicly identify the two companies nor divulge the legal grounds for "forbidding" them to sell the crude, but it was common knowledge in Caracas that Sun Oil and Superior Oil were the two involved.

Both companies are newcomers to Venezuela and both established sizable production in Lake Maracaibo after making large capital investments on exploration programs and bonuses for concessions. Now that both are ready to produce, markets for the crude are hard to find.

The price cut in the Middle East cast Perez Alfonzo in the role of a seer. It came less than a week after he had predicted such a move in print in Venezuela. Writing for the Venezuelan press, the minister outlined his own pricing theories and said "pressures" from the world's big consuming countries might force a world oil price cut.

He said if such a cut came, it probably would be started by "an international company of the United States" rather than one of the British companies.

A staunch advocate of world-wide proration to keep prices up, Perez Alfonzo has been extremely bitter in his denunciation of British Petroleum, the company he blames for the last series of price cuts in 1959. This time he predicted it would be an American firm.

"The word in London is that in all probability it will not be the British Petroleum nor the Shell group that will take the first step because of the political repercussions which such a move might have," he said.

He referred, of course, to the large political stake which the British have in the Middle East.

On a rather bitter note, the Venezuelan oil minister added:

"The truth is that the United Kingdom is the greatest consumer of Western Europe, the same as the United States is the biggest consumer of imported oil in the world. The reduction of prices favor as we have said before those who consume most. Thus, the British and U. S. interests in the oil prices are the greatest.

Minister's philosophy . . . As a part of his statement on prices, the Venezuelan minister set forth some definite points which he says Venezuela will follow with regard to its oil. They are:

. . . **Price wars** are bad for Venezuela and the country should not allow itself to get pushed into them. It is preferable, he says, to reduce sales rather than try to maintain income by wasting oil.

. . . **Geographic position** of Venezuela is a definite advantage for the country and one it should make full use of as long as diversified sources of oil are as important as they are today.

. . . **New sources** of supply such as the Sahara and Libya and the available surplus of the Soviet Union "which have been given so much publicity in the world's press" do not have the relative importance which is attributed to them. The constant increase in world demand allows for that supply without the necessity of upsetting markets or prices.

. . . **The Middle East** is well aware of its fundamental interests and of the responsibility which it has to the world market.

Russian Role . . . Esso's comment that Russian oil is playing a part in the downward swing of prices means that Black Sea oil is again a serious factor in world prices for the first time since the days of the Czar.

Soviet exports last year rose 39.8% to 507,000 bbl. daily. Free world countries took 292,000 bbl. daily of crude and products. The Soviets deny they are dumping oil for political purposes, but most of the oil is moving at discounts of 10% to 25% off world prices.

Payment often is in barter or cur-

Arab leader says:

Politics, Not Economics, Behind Russian Deals

THE THREAT of Russian oil may have to be met by the governments of free-world nations, an Arab oil official said in Washington last week.

Dr. Mohammad Salman, director general of the department of petroleum affairs of the League of Arab States, made it clear he does not feel that the oil producing nations nor the companies operating in them should be expected to bear the brunt of crude price cuts arising from the Russian move.

He thinks this is especially so if, as he suspects, the Russian drive is based on political and propaganda motives. If on the other hand it is solely economic competition, he said the Arab nations are perfectly willing to meet it on that basis.

In other words, he considers it one problem if the Russians are able to produce crude more cheaply than other nations, but it is another problem if they are subsidizing oil export operations for political or propaganda gains.

Dr. Salman, who was visiting in Washington at the time Esso Export Corp. announced its price cuts on Middle East crudes, clearly leans to the latter theory.

He did not outline any specific program of action but he did say that Arab nations will restrict their production if cuts continue.

And he said the Arab countries would like to cooperate with other oil producing nations to stabilize world oil operations.

Dr. Salman also feels that oil companies should consult with the government of the producing nation before making a price cut. He said this would enable the government to try other moves to offset the Russian price action or any other factor tending to lead to price cuts.

Unless some such an approach is used, he said, price cutting could get into a vicious cycle.

The director general thinks that the continuing rise in world oil demand makes price cuts unnecessary anyway—and extremely unfair to producing nations.

He pointed out the importance of oil revenue to the Arab nations, saying that price cuts disrupted national budgets and hindered much-needed development programs.

Dr. Salman will serve as secretary-general of the second Arab petroleum conference in Beirut in October. He was secretary-general of the first such conference, held in Cairo last year.

rency of the importing countries (OGJ, Aug. 8, p. 65).

A promise of Russian oil supplies was behind Premier Castro's takeover of refining and marketing facilities in Cuba. In other areas international companies are meeting Soviet competition for markets head on. Two of the spots where the Russians most recently have tried to crack into the market are India and Australia.

The Indian Government has broken off talks with the Russians over the import of Black Sea crude. This followed a refusal by western refiners to handle the oil and an offer to nearly match a price reduction offered by Russia.

Burmah-Shell, owned jointly by Royal Dutch-Shell and Burmah Oil Co., and Stanvac each reduced the price of laid-down crude in India by about 12½%. A Caltex cut was more than 11%. The Russians reportedly offered a 13% discount.

Russia still gained a partial foothold by winning an agreement to supply 1.5 million tons or about 11-million barrels of kerosine and diesel oil in the next 3 to 4 years. Deliveries are scheduled to start this month.

Russia stubbed its toe in Australia and it has launched a propaganda campaign to cry about it. Sojuzneftexport, the USSR's oil exporting organization, charges that established companies were responsible for Russian failure to obtain contracts in Australia last spring. I. Fyodorov, director of Sojuzneftexport's eastern division, who returned empty-handed to Moscow, called Stanvac, British Petroleum, Caltex, and Shell the chief culprits.

Fyodorov, writing in the magazine "Novoye Vremya" (New Times), said that before his visit to Australia the Russian embassy at Canberra "received many inquiries about Soviet oil and the opportunities for selling Soviet oil in the country seemed fairly good."

Fyodorov said Russian crude would be at least 10% cheaper. Soviet gasoline, paraffin, and other products would cost Australians 10 to 15% less than from existing suppliers.

He added that his own talks with directors of local oil companies convinced him they are interested in buying Soviet oil, but they are bound to present supplies by contracts.

The Russians plan to keep trying, Fyodorov said. "I believe there is some likelihood of demolishing the present artificial barrier of revising the present pattern and of opening Australia to Soviet crude and products at some future time."

Iraq unsettled . . . The Middle East price cut is hitting the volatile region at a time of comparative oil peace with the exception of one place—Iraq.

Iraq Petroleum Co. is under fire locally because the affiliated Basrah Petroleum Co. last month temporarily shut down Rumaila oil field. This was forced on the company when incoming tankers heading for the Persian Gulf port of Fao were diverted after the local port authority arbitrarily increased the loading fee. The new levy was about 10 cents per barrel or about 10 times higher.

Negotiations between IPC and the government over the disputed fee now are in progress. Rumaila reopened when liftings started after no effort was made to enforce the charge on a test-case tanker.

Many observers believe there is far more to the dispute than meets the eye. Premier Kassim's lustre may be fading in the eyes of the Iraqi public and IPC may be a handy whipping boy with which to restore his popularity. Crude production is at an all-time high in the country, reaching the 1-million barrels daily level for the first time in June. The government's oil income for the first 4 months of the year reportedly was $68 million.

The squabble over harbor fees did not deter the government from opening Iraq's offshore areas in the Persian Gulf to bidding. Offers for the acreage must be submitted by companies within 6 months. The government also plans to invest $56 million in a 40,000-bbl. refinery at Basrah to be built within 5 years. The plant will replace a 3,250-bbl. refinery at Muftieh Depot at Basrah and a small plant at Al-Want Wand.

The government forecasts a demand of almost 40,000 bbl. daily in southern Iraq by 1966. It expects the new refinery to enable it to export about 12,000 bbl. daily of gasoline, kerosine, and gas oil.

What's Involved in the Hess Deal

Hess is getting—

. . . Gulf's pipelines from Eucutta and Baxterville to Mobile.

. . . Deepwater terminaling and tanker-loading facilities at Mobile.

. . . Assured crude supply for its expanded refinery in New Jersey.

. . . Preferential position to gather or purchase crude in active drilling areas in southeastern Mississippi (colored fields on map).

. . . First call on Citronelle's rejuvenating production.

Deals Speed Amazing Hess Growth

• East Coast independent will jump into integrated-company ranks if deal goes through with Gulf Oil for deepwater Mobile terminal and pipeline system running into southeastern Mississippi.

HESS Trading & Transport, Inc., is about to emerge as a fully integrated oil company of semimajor proportions.

It is acquiring a crude supply and a pipeline system, is enlarging its refinery, and is entering direct marketing of products under its own brand name.

The biggest link in a chain of related negotiations, some of which are still pending, is acquisition from Gulf Oil Corp. of a deepwater tanker terminal at Mobile, Ala., and Gulf's pipeline system running into Mobile from southeastern Mississippi.

This gives Hess an assured source for a big portion of the crude supply for its refinery at Sewaren, N. J. The refinery is now undergoing a revamping and expansion program which will permit it to handle these types of crudes. The expansion will give the plant a throughput of 75,000 bbl. per day by December or January.

The Gulf line being acquired handles about 40,000 bbl. per day of Mississippi crude, and an additional 20,000 bbl. per day is moving through the Mobile terminal from Alabama fields. Much of this crude is under long-term contract. But the remainder moves on the spot market, and thus is available for Hess to purchase either for use or for exchange.

In addition, Hess is acquiring crude production of its own. Negotiations now in progress may give the company crude production equal to nearly half of its refining capacity.

Not included in the transaction is the 30-mile 8-in. pipeline from Citronelle, Ala., to the Mobile terminal which Gulf sold to operators in Citronelle field early last year (OGJ, May 11, 1959, p. 78). However, Hess has expressed some interest in Citronelle crude, now totaling 16,000 to 20,000 bbl. per day, and could become the purchaser of much of it. This possibility has spurred Citronelle operators into drafting a unitization plan and secondary-recovery program.

The pipeline . . . The system Hess is buying from Gulf serves several fields.

There is a 14-in. line running from Baxterville field eastward to Mobile via the main pump station at Lumberton. A 10-in. line runs from Eucutta to join the 14-in. at Lumberton.

Baxterville crude is a heavy, asphalt type of 16° to 17° gravity, and must be heated to produce and move. There are eight heater stations spaced about 9 miles apart on the 88 miles of line between Lumberton and Mobile. Baxterville crude has a posted price of $2.00 per barrel; and because of this

price and its prime asphalt yield; it is in good demand at present.

The northern leg of the system moves what crude buyers nickname the "HEY stream" because most of it comes from Heidelburg, Eucutta, and Yellow Creek fields. This stream has a gravity range of 20° to 25°, and sells on a posting ranging from $2.38 for 30° gravity and above down to $2.12 for 18° gravity and below. Gathering, pipeline, and terminaling charges amount to 22.5 cents per barrel.

The Eucutta terminal is fed by a V-shaped gathering system once owned by Interstate Oil Pipe Line Co. but now operated as Trans-State Gathering system. In addition, considerable crude is trucked into the system from a number of small fields in the vicinity.

During the last couple of years there has been a steady drilling activity in the area north and east of Laurel, resulting in a number of discoveries. Many of these fields yield a heavy crude similar to the HEY stream, but several deeper fields yield light crudes and gas-condensate. Deeper drilling in some of the older fields has also found the light-crude pay.

Thus, it is quite possible that the admixture of these lighter crudes will upgrade the quality of the entire stream and make it more attractive to more refiners.

The advent of a new crude purchaser in this region and the prospect of additional market outlets may stimulate activity in the region even more.

No surprise . . . Gulf's sale of its Mississippi-Mobile system comes as no great surprise to the industry.

During the past few years, in common with some other major oil companies, Gulf has been in a mood to dispose of various crude-gathering systems.

Such companies do not like to be permanently committed to use or find a home for all the crude on their present connections, particularly where the crude is so located or is of such a type that it does not fit into the company's refining pattern.

Hess has been in the market for assured crude supplies along the Gulf Coast for the past year or more. It has tanker terminals in the Houston and New Orleans area, has a fleet of tankers, and does a big terminaling and brokerage business in both crude and refined products. The Hess refinery has been obtaining crude from a wide variety of sources in West Texas and along the Gulf Coast, much of it on a spot basis.

The Hess refinery at Sewaren is on Arthur Kill opposite Staten Island near Perth Amboy, and has a deepwater terminal. It is a modern plant, having been completed in 1959.

The plant originally was planned to operate largely on imported crude, but import controls were imposed while it was under construction. Hess has a crude import quota of 7,420 bbl. per day.

Hess is building a 30,000-bbl. fluid cat cracker, a 15,000-bbl. hydrogen-treating unit, a 40,000-bbl. vacuum unit, and a 2,500-bbl. sulfuric alkylation unit. This work is scheduled for completion about the end of this year.

Marketing plans . . . A considerable portion of the Hess refinery's capacity is currently taken up by processing agreements with other companies.

Heretofore Hess has marketed its own products primarily through private-branded jobbers and dealers. Hess has a part ownership in Meadville Corp., which operates service stations in northern New Jersey under Saveway, Merit, and Giant brands.

Just recently, however, Hess announced plans to market gasoline under the "Hess" brand name and has opened its first two stations in New Jersey. These stations have posted a price for regular gasoline 2 cents per gallon below that posted by major companies under the state's fair-trade law.

The growth of the Hess operation into an integrated oil company is the work of Leon Hess, a quiet and uncommunicative man who started as a fuel-oil distributor with a single truck.

He built up a large fuel-oil jobbing and terminaling business in the New York Harbor area and then expanded to the Gulf Coast. He now owns the only independent refinery on the entire Atlantic Coast. The acquisition of the Mississippi gathering system and the crude connections and division orders that go with it, plus crude production of its own, makes Hess Trading & Transport a truly integrated oil company.

The Citronelle story . . . The substitution of Hess for Gulf as a crude buyer and gatherer in the Mobile area puts Citronelle field in an ambiguous and tantalizing position.

At one time Gulf was the largest producer in Citronelle and built a 30-mile 8-in. pipeline from the field to the Mobile terminal. In May 1959, Gulf sold its Citronelle leases and producing wells, 15 miles of field-gathering lines, and the trunk line into Mobile to a group of independent producers in the field. The buyers were headed by G. H. Jett, of Jett Drilling Co., Shreveport, and Bart H. Chamberlain, Jr., a Mobile attorney and oil operator (OGJ, May 11, 1959, p. 78).

Jett and Chamberlain operate the pipeline as a partnership under the name of Citronelle-Mobile Gathering System, Ltd.—nicknamed Citmoco by the industry. At the time of the sale, Gulf agreed to buy 12,500 bbl. per day of Citronelle crude for 18 months, and 6,250 bbl. per day for another 18 months. The first period is about up, and Citronelle producers have been looking for a new market outlet.

Some time ago Hess studied Citronelle crude but decided that its price and quality were not attractive at that time.

Citronelle crude has peculiar characteristics which make it unattractive to most refiners. Its gravity is about 42°, and it has a high gasoline yield. But it yields a small amount of wax in the paraffin distillate which gives a high pour-point jet fuel.

The field price posted by Gulf was $2.985 per barrel, flat. There is a gathering and pipeline charge of 20 cents to Mobile, and Gulf's terminal-

Potential of Fields Feeding Gulf Pipeline

(May production, bbl. per day)

Mostly low gravity		High gravity, condensate	
Baxterville	16,266	Soso	10,695
Heidelburg	7,288	Bryan	6,741
Eucutta	3,507	Diamond	3,221
Yellow Creek	2,723	Pistol Ridge	1,575
Sandersville	947	Maxie	844
Thompson's Creek	705	Laurel	315
Chaparral	532	Gitano	98
Langsdale	504		
Junction City	492		
Ovett	350		
Glazier	81		
Carmichael	42		
Total	33,437		23,489
GRAND TOTAL			**56,926**

ing charge had been 2.5 cents per barrel. This puts Citronelle crude f.o.b. tanker at a price about on a par with other Gulf Coast crudes, some of which have more attractive refining characteristics.

Until a few months ago, Citronelle was producing about 16,000 bbl. per day. Then another purchaser entered the field and posted a price of $2.645—though most of the crude has kept its higher posting. The lower price attracted new markets and under this stimulus production increased to 19,000 bbl. per day in May and to 22,000 bbl. per day in June.

Gulf remains the biggest purchaser of Citronelle crude, but Mobil Oil, Delta Refining, and Ingram Refining have used some recently.

Production troubles . . . Field engineers say that Citronelle cannot maintain its recent production peak very long, and that even intensive development drilling could not offset the decline curve of primary production.

Plans for unitizing and water flooding Citronelle have been under discussion for a year or more. Last February, Jett Drilling, largest operator in the field, employed William L. Horner, well-known reservoir engineer and formerly vice president of Core Laboratories, to perfect plans for increasing production.

Late in July, stimulated by the prospect of new markets, 34 working-interest operators — representing a big majority of the field's production— agreed to the outlines of an initial unitization plan. Unit-agreement contracts are now being drafted. It is an interim plan, permitting water flooding to start in the heart of the field, and designed to be extended later.

Citronelle produces from the Rodessa formation at about 10,800 ft. The field has no natural water drive and had no original gas cap. Reservoir pressure is declining, but has not yet reached the bubble point. The pay sand is tight and shaly, per well production is low, and many of the wells are unable to make the state allowable.

Engineering studies have established the technical feasibility of secondary recovery, probably by a combined water and LPG flood, and economic studies are now in progress. However, the combination of a good market and unit operation would make it possible to increase producibility within a short time by reworking and fracturing existing wells.

At present there are about 245 producing wells in Citronelle, 150 undrilled locations, and 2 development rigs running. If a secondary-recovery plan is adopted, a substantial drilling program might be launched immediately.

Penalty on Multiple Wells

• Oil men oppose Louisiana's order which grants only one allowable to multiples, but can't agree on a substitute method of holding down production.

OFFICIALS of Louisiana Conservation Commission have under advisement the protests of important oil producers for a better allowable break for multiple completions.

The protests were made at a hearing in Lafayette last week on the 2-month-old commission order giving only a single allowable for all newly completed wells in the state no matter from how many zones they produce.

Effect of this order is to remove a powerful economic stimulus to multiple completions and prolong the payoff period for drilling ventures.

In originally issuing the painful order, outgoing Conservation Commissioner Ashton Mouton described is as a stopgap measure to help keep production in line with demand.

New Commissioner James H. Gill gave no indication at last week's hearing that he differed from his predecessor's position.

For several years now, new completions have continued to add to Louisiana's total daily oil production even while per well allowables have been cut a half dozen times.

Most frequently advanced plan to alleviate the oversupply problem has been to promote wider spacing. The commission is expected this week to release its proposal for this end. However, it will still be several months before such a plan can be put into effect; and it's uncertain how much immediate effect wider spacing would have on new production.

In the meantime, the ban on most new multiple completions makes an immediate cut in new oil. That fact alone may force its continuance.

Many plans offered . . . While all producers at the Lafayette hearing acknowledged the presence of an oversupply problem, none thought the ban on multiple completions is the way to handle it.

Any agreement between the producers ended here. Almost none agreed on what other measures should be taken to curb oil supply. Few concurred on how multiple-completions should be handled.

First to give its opinion at the hearing was Continental Oil Co.'s P. D. Perkins. He said Conoco would like to see the ban lifted entirely. Failing that, he said, the ban should not be applied to duals, but only to completions of three or more zones.

The Texaco representative suggested a token cut of "one or two %" in allowable for all zones after the first.

Tennessee Gas & Oil Co. made the most outspoken attack on the ban, saying that it might easily result in a worse recession in offshore drilling than the one of 1957 and 1958. Better to cut per well allowable, Tennessee held, than to run the risk of prompting federal regulation of the offshore areas.

Sun Oil Co. suggested a return to the 1957 regulation which gave the second zone of a dual only 50% of its normal depth-bracket allowable.

Pinch really hurts . . . There's no doubt that the inability to make multiple completions makes it harder to pay out new drilling.

Actually, the order doesn't prohibit all multiples; and it doesn't stop oil companies from installing multiple equipment. It does stop the operator from getting more than one allowable in most cases.

Gas completions aren't affected, nor are oil sands in fields where they have already been multiply completed. Thus, most seriously affected are those seeking new production in the multipay country on the coastal fringe of the state.

Tennessee, which has plunged heavily into the offshore oil search this year, stated flatly that it couldn't pay out offshore wells with single completions.

Conoco cited two fields onshore where twin wells are a great expense compared to duals. At Johnson Bayou, the company said, it costs $24,400 to recomplete a single well as a dual. Cost of a twin well is $101,300. At Abbeville, the dual can be made for an extra $16,500 while the additional well would be $75,500.

Probably most worried among those at the hearing were not producers at all, but offshore drilling contractors. Almost half of all offshore wells are multiply completed. And a long-term ban on dual completions could easily force a slowdown in offshore drilling. Such a

May Stick

slowdown could spell disaster for the offshore contractors who only now are beginning to recover from their private debacle of 2 years ago.

Opposition from landlords . . . All the support for the ban came from representatives of landowners—mostly large landowners. All their support was based on fear of what further oversupply could do to the price of crude oil.

Biggest landowner of all—the state of Louisiana—was represented by W. G. Helis, Jr., chairman of the state mineral board. Helis' title makes him custodian of state lands, offshore and on, leased out for oil exploration. Besides his official position, Helis is an independent oil operator.

The producers want the order rescinded, Helis said; but they have no concrete studies of costs to show that single completions are not as a rule sufficiently profitable.

Helis' position was backed by the giant land company, the Louisiana Land & Exploration Co., and representatives of two other landowner groups.

Over in a hurry . . . The hearing on multiple completions lasted only 2 hours.

Brevity of the session is no testimony to the strong feelings of the producers, but it does reveal how little argument was made in the case. Most of the time was absorbed by company representatives reading prepared statements. There was almost no discussion of the material in these statements, although many contained points of real controversy.

For instance, no one protested when it was suggested that per-well allowable be cut over the entire state.

No rebuttal came forth when a case was made for returning to the 1957 plan of giving the dual only 1½ allowables instead of 2.

Even when Tennessee Gas & Oil suggested the possibility of federal regulation offshore, no one rose to condemn this traditional boogeyman.

Significantly, two of Louisiana's biggest producers said nothing at all. Neither Shell Oil Co. nor Gulf Oil Corp. made a proposal. Neither lent its weight to statements of the other companies.

When the last producer was heard, officials of the conservation commission offered no opinions of their own. Rather, they said, they would ponder the testimony given at the hearing, and at some future date a decision would be announced.

watching WASHINGTON

Clyde La Motte

• Operation was successful, but the patient died . . .

THE FEDERAL Power Commission, trying hard to chart a course through the maze of court decisions affecting natural-gas regulation, often finds itself handing down awkward, if not absurd, decisions.

The other day, for example, it trimmed a gas price from 20 cents to 18 cents even though one commission member pointed out that this probably would kill the project because the producers could get a higher price selling to industrial buyers and thus avoid dealing with the FPC at all.

The case involved a proposed sale of gas by seven Texas producers to Peoples Gulf Coast Natural Gas Pipeline Co.

Originally, the FPC had approved a sale price of 20 cents, but had trimmed down escalation clauses contained in the contracts.

When the producers objected, the FPC withdrew the escalation reduction requirement but cut the sale price to 18 cents.

Commissioner Arthur Kline reluctantly went along with the majority on this action, but noted that the large purchases of gas currently being made in that area by out-of-state industrial users at higher prices, and the rapid industrial expansion in that part of Texas "lead me to the conclusion that in a short time there will be no gas available for the interstate market at a price of 18 cents."

Kline expressed the fear that the limitation to 18 cents would kill the proposed project entirely. Even so, the commission felt obliged to prescribe 18 cents.

This is somewhat similar to the situation in which a surgeon performed a delicate operation. Asked by a colleague about the outcome, the surgeon said the operation had been quite successful, but the patient died.

• Courts rule that costs must be considered, but . . .

IN MANY natural-gas cases, the FPC cites the fact that Supreme Court decisions make it mandatory that costs be given strong consideration when gas rates are established. But this weapon also can be a two-edged sword.

Take the case cited above. The FPC declared that even if it were to accept the producers' cost estimates of 35 cents or more, it still could not approve the original price of 20 cents. The reason: It could not be proved that public convenience and necessity justified such "expensive" gas.

The net effect of such an approach seems to be that cost figures can be used to justify keeping prices down but should not be used to justify higher prices.

The producer may find it difficult to appreciate fully that line of reasoning.

• Producers chief hope: Legislation next year . . .

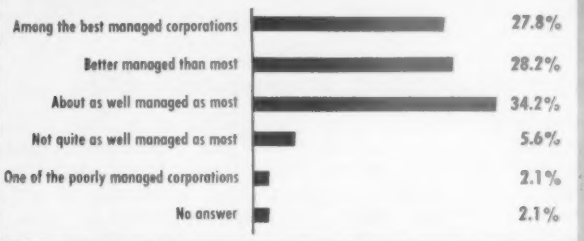
WHILE THE FPC continues to struggle with its complex problems, an intra-industry group is continuing to try to shape up proposals for legislation which would help clarify and simplify the situation.

The committee, made up of representatives of producers, pipeliners, and gas distribution companies, has been meeting periodically during the past year and has hopes of readying its proposals this fall so that a drive can be launched early next year to get action by Congress.

If this joint approach fails to materialize, then the legislative effort will no doubt be undertaken by some producers' group, such as the Independent Petroleum Association of America. It is safe to assume, therefore, that a major effort will be made when the new Congress convenes next year.

Some Highlights of Socal's 'Opinion Poll'

Looking at Standard of California (the whole corporate family) as compared with other corporations, I would say it is:


Among the best managed corporations 27.8%
Better managed than most 28.2%
About as well managed as most 34.2%
Not quite as well managed as most 5.6%
One of the poorly managed corporations 2.1%
No answer 2.1%

A. Compared with other oil companies do you think the company provides:

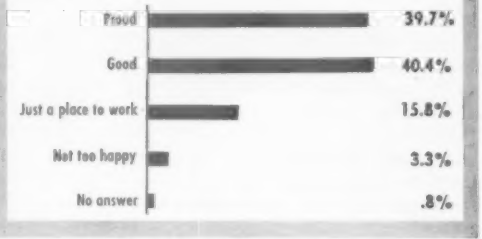
B. Compared with companies not in the oil industry do you think the company provides:

	A. Other oil	B. Non-oil
More and better benefits	28.4%	43.2%
About the same benefits	48.8%	30.7%
Less	10.3%	16.6%
Don't Know	11.8%	8.9%
No answer	.7%	.6%

Which benefit in each of the three following areas is the most important to you?

Income Protection		Family Protection		Retirement Protection	
Holidays	.7%	Life Insurance	58.8%	Annuity Plan	64.8%
Vacations	9.9%	Stock Plan	23.9%	Life Insurance	3.2%
Sickness	43.2%	Survivor Protection	12.4%	Medical Insurance	7.1%
Industrial Injury	3.8%	No Answer	4.9%	Stock Plan	15.4%
Medical Insurance	25.9%			Social Security	5.2%
Legally Required Plans	12.8%			No Answer	4.3%
No Answer	3.7%				

How do you feel when you tell people what company you work for?



Employes Tell Boss What They Think

- Standard of California learns just exactly what employes think of the company with new opinion poll. And there's something for any company to learn from the answers submitted by 29,000 Socal workers.

AN EMPLOYE-OPINION poll just completed by Standard Oil Co. of California carries some lessons any oil company might learn about its operations.

Socal workers face many of the problems any oil-company employe faces and the most pressing of these problems are obvious in some of the write-in comments picked up in the poll. They very well could be the same comments any company might get from its employes.

Here are some of the questions Socal employes find most difficult to answer when questioned by friends:

"Why do we have a depletion allowance?"

"Why are our gas prices higher than some other companies?"

"Why does Standard Oil allow price wars?"

These are a sampling of the 135,000 comments volunteered by Socal workers. And Socal expects to learn a great deal about what their employes are thinking by analyzing these and other comments.

The company scored a real success in the write-in department. Nine out of every 10 employes wrote in comments on about five subjects.

The opinion poll is the second conducted by California Standard and it covers many more employes than the original poll in 1955. The 1960 poll covered 29,000 employes compared to the 16,000 in the 1955 poll. More people are working for the company and the new poll was extended to some areas not covered in the original.

The 1960 poll covered all of Socal's operating subsidiaries — Standard of Texas, The California Co., California Chemical, American Bitumuls, etc.— but did not include employes of such affiliates as Arabian American Oil Co.

The poll gave employes the opportunity to give their frank opinion of just what they think of the company they work for. It was strictly an anonymous affair and some of the critical answers showed some employes welcomed the chance to sound off on their pet subjects. Some comments obviously were sour grapes. Many others were sound statements which showed considerable thought.

Results of the poll give Socal's management plenty of material to study in mapping future employe-relations plans. It tells management where there are weaknesses in the program and what areas need the most attention.

Management . . . The boss rates pretty high with Socal employes.

The poll showed 27.8% of the employes think the company is among the best managed corporations. Another 28.2% rated the company better than most. Only 7.7% feel Socal is not as well managed as most companies or poorly managed.

In general, the company and the way it operates rated high in the poll, but one question probably has Socal management wondering. This is the

question concerning whether the employe would go to work again for Socal if he were starting over. The answers showed: 58.4%, yes; 15.8%, no; 24.7%, don't know; and 1.1%, no answer. Apparently, the employes are happy with their work, but many aren't sure they would want to go the same route if starting from scratch.

The company has made no official statement on results of the poll, but some of the major points are scheduled to be published later in the company's employe magazine. The results are being compiled for Socal by California Institute of Technology.

The comments . . . The answers to the 35 questions covered by the poll are packed full of solid information, but the write-in comments are equally as valuable—and to the outsider—entertaining.

The poll is part of Socal's "Program for Communications" and here's what one employe said about the program:

"My present opinion of the current 'communications' program is summarized by the following quotation from Abraham Lincoln: 'Give me a little more light and a little less noise.' "

Another unhappy soul, taking the opportunity to express what he likes least about Socal, said his supervisor is "too grumpy and not friendly and his answer is always 'no.' "

On the other side of the ledger, there are many things Socal employes like about their company.

"It is a well managed, money making organization," one employe wrote.

Another worker said he felt the company offered him an opportunity to go "as far as my talents will permit."

And there is the worker who summed up the company in this manner:

"The company is like a wife of many years. You don't always understand her. You disagree with some of the things she does. Occasionally, you get mad at her, but you wouldn't trade her for any other for anything."

New Guides Set on Oil Goods Pricing Policy

• Court decisions on beer and food pricing practices clarify points on sales in interstate commerce.

BUYERS AND SELLERS of petroleum equipment are taking a close look at two new U. S. Supreme Court decisions which affect directly pricing practices of interstate commerce.

While the two cases do not deal with oil equipment, the principles involved are pertinent.

In fact, the Petroleum Equipment Suppliers Association considered the decisions sufficiently important to call on its attorney, Leroy Jeffers, for an interpretation.

The two cases, Jeffers warned, emphasize the necessity for watching pricing practices to avoid a violation of the federal Robinson-Patman Act. The decisions hold that:

. . . Prices cannot be lowered to a favored buyer by cutting a commission rate unless the same preferential treatment is given all buyers of a like quantity or quality of product.

. . . Prices cannot be cut in one area (to the injury of competing sellers) and not be cut in other areas, even though there is no discrimination between competing buyers.

Attorney Jeffers also cited a third court case of significance to the industry. The Second U. S. Court of Appeals held in June that buyers who knowingly r e c e i v e discriminatory prices are equally guilty with the sellers of violating the Robinson-Patman Act.

The Robinson-Patman Act w a s passed in 1936 to prevent large buyers from gaining discriminatory preference over smaller buyers because of greater purchasing power.

The Broch case . . . The new decisions which clarify points of the law went to the federal courts from the Federal Trade Commission.

In FTC vs. Henry Broch & Co., the Supreme Court held that the broker for a food processor could not reduce his commission rate from 5 to 3% and thus give a particular buyer a price of $1.25 per unit instead of $1.30 charged to others.

The broker, said the court, can violate the Robinson-Patman Act just as easily as the seller. While the seller and the broker can agree on any commission rate they choose, they cannot reduce the fee for a favored buyer but must do it for all buyers.

"Congress enacted the Robinson-Patman Act to prevent sellers and sellers' brokers from yielding to the economic pressures of a large buying organization by granting unfair preferences in connection with the sale of goods," the court said. "The form in which the buyer pressure is exerted is immaterial, and proof of its existence is not required."

The court's decision does not place an "irrevocable floor" under commission rates but holds simply that if the rate is cut for one buyer, it must be cut for all.

In applying the decision to the oil industry, one PESA leader said last week that supply houses are the same as brokers since they represent manufacturers and charge an established discount to market the goods to the ultimate customer.

Anheuser-Busch . . . The second case involves area pricing of Anheuser-Busch's premium beer.

The company cut its prices in the St. Louis market without making the same cut in other areas. All the St. Louis dealers got the same low price, while dealers in other areas got the same higher price. While there was no competition between dealers in St. Louis with dealers of other areas, the court held that, nevertheless, the Robinson-Patman Act had been violated.

Earlier, in the U. S. Court of Appeals, the decision went the other way. The court said that since all competing purchasers paid Anheuser-Busch the same price for beer, there was no discrimination—the price cuts had been directed at the beer company's local competitors, not at its customers.

But the Supreme Court reversed this holding and said there was a "price discrimination which deals the requisite injury to primary-line competition, even though secondary-line and tertiary-line competition are unaffected."

By this the court meant that Congress, in passing the Robinson-Patman Act, was seeking to curb the use of local price-cutting by financially powerful companies to hurt competition. Also the law seeks to protect competitors of the "discriminating seller."

The law does not prevent price differences between areas that occur b e c a u s e of differences in freight, manufacturing cost, costs of sale, or delivery r e s u l t i n g from differing methods or quantities under which goods are sold or delivered. Also a company may lower a price in an individual competitive situation to meet a competitor's low price.

But area price differences cannot, according to the law, be used "substantially to lessen competition or tend to create a monopoly. . ."

Scouts Fight to Keep Jobs Alive

• The scouts hit hard at commercial services, claiming there are many important aspects of scouting missing from the services. And they say it is cheaper to maintain scouting departments than go the service route.

Robert J. Enright
District Editor

OIL SCOUTS are bringing up their big guns for a fight to persuade operators to keep their scouting organizations and the scout check and to repel further invasion of this field by commercial services.

They have enlisted heavy management support in some areas, especially at the district and division levels.

The scout drive to win more management minds is based on two arguments—costs and service.

Spokesmen for the scouts argue that a multi-interest service simply cannot provide an operator the services he is getting or can get via a good scouting department of his own coupled with a solid, cooperative check.

Furthermore, they argue, management in some cases has been sold a bill of goods on costs of the commercial service. The service is cheaper, they contend, only on superficial, surface examination.

The scouts also quarrel with another of the sales arguments of the commercial service — that via such subscription the operator can shift his scouts to more important duties. What usually happens, however, is that the operator lays off his scouts—and suffers for it later, the scout groups contend. And, once a scout department has been disbanded, it is improbable that an operator can reestablish it without heavy cost in information, time, and money.

Some operators, the scouts point out, have already learned this to their sorrow. Though the commercial services are still quite young, some operators who had dropped out of scout checks and released their scouts to take a service now are rejoining the same checks.

1. Service advantages

Active defense of the scout check is being led by scouts in the Texas Oklahoma Panhandle and western Kansas, an area embracing the Amarillo and Liberal, Kans., checks.

The two checks have been streamlined in recent years. They have gone to the speedy printed-ticket system for completions. They work cooperatively to cover "hot" border counties in which each is interested.

Scouts in these checks—joined by a number of chief geologists, land-department heads, and managers in the area—state flatly operators cannot begin to get the services they now enjoy by switching to a commercial service.

Here, they contend, is what the operator wouldn't get:

... **Lease "takeoffs."** Scouts in these checks must make the rounds of the county courthouses in the region covered each week.

They pick up from each county every change in lease ownership—whether it is a new lease, an assignment, or a release.

The weekly courthouse beat keeps the companies in the check constantly informed on any play that might be developing. Along with this, it gives them the data to keep their lease maps up-to-date.

The latter would be a major expense item otherwise. Without this information from the check, an operator would either have to rely on purchased maps which would quickly get out of date, or he would have to subscribe to an abstract service which would supply the data on a weekly basis.

Going rates for such a service run at least $10 a month per county and often more. One major company operating in the area estimates that it would cost it at least $420 a month in abstract-service fees alone for the 42 counties in which it is interested if it left the check.

The check of courthouse lease records, the scouts say, pays off in many other ways, too. Here's one instance. Operator A asked Operator B (an adjoining acreage holder) to contribute dry-hole money for a deep test on Operator A's acreage in the Panhandle. Operator B declined because it knew—due to the courthouse check of lease records—that Operator A had legally committed itself to drill the wildcat as a part of the terms of the lease with the landowner. Thus, Operator A would have to drill the test anyhow—with or without dry-hole money.

In another instance, a company scout in the check discovered a highly desirable lease had been erroneously recorded at the court house as of 10 years' duration rather than the actual 5 years. The company was able to pick up the lease—which is now producing—at a reasonable price long before any other company knew it was available.

... **Geophysical sleuthing.** Another important bonus which Panhandle operators get from their scout check is the weekly rundown on geophysical crews operating in the area.

Companies in the check know exactly where such seismic, magnetometer, gravity-meter, or other kind of party is working. They know who each crew is working for, how long it spends in each particular portion of its survey area, and when it leaves the area.

Company members of the check furnish the data on their own crews to other members. And the scouts are detailed to run down and keep weekly track of any crews operating for firms that are not members of the check.

This information can be extremely helpful.

Given to company geological departments, this data can be—and is—actually contoured on maps according to how long a party spends in each portion of its working area. Operator A, by doing this, can keep tabs on what Operator B finds unusually interesting in its geophysical work. If the crew should spend several weeks working over one limited area, Operator A is alerted to the need for watching this area closely and being ready to put its landmen to work fast.

Thousands of acres with good oil or gas potential have been leased through use of this technique. One manager of a major company in West Texas told the Journal his firm had leased several thousand acres recently on one occasion on just such grounds.

"We had no shooting in this particular area but had a nice subsurface geological picture that interested us. A seismic crew for another company started working the area. Through the scout check, we watched it work. And it spent week after week in one portion. We figured this bore out our subsurface dope and immediately started leasing. We beat other operators and got in while lease costs were low. We now have large-scale production from these leases."

Scouts point out that this kind and caliber of geophysical information

TESTIMONIALS for scouting departments were given by speakers* at Amarillo dinner.

Scout Checks Get Strong Endorsements at Amarillo

COMPANY executives in land, geological, and scouting departments spoke out strongly in Amarillo last week in support of oil scouting in general and the scout check in particular.

The support was voiced at a dinner meeting sponsored by the Panhandle and Liberal Oil Scouts associations. The meeting drew about 80 scouts and executives from the Panhandle, West Texas, New Mexico, the Gulf Coast, Oklahoma, and Kansas, and other areas.

Free-swinging addresses were given by: Wesley Weed, head of the land department of Sun Oil Co.'s Southwest division at Dallas; Harry Britt, chief geologist for Shamrock Oil & Gas Corp., Amarillo; and Sam Garrison, president of the International Oil Scouts Association and chief scout for Humble Oil & Refining Co. at Houston.

Weed defended the scout check as "one of the few remaining examples of industry cooperation—and if the industry ever needed cooperation, it needs it now." The Sun executive said his company has complete confidence in its scouts and will keep them to get information it could not obtain any other way.

We have to have "all the data and know it is accurate."

"And we feel much better if vital information such as drill-stem tests, core data, and formation tops are not second hand."

In at least two instances during the past year, Weed said, "our scouts have made us more money than the entire scout force costs us for a whole year by getting us data we couldn't get elsewhere."

Look harder at costs . . . Operators should take a good long look at comparative costs of commercial services and the scout-check setup, Garrison said.

The company scout, he said, spends only about 2 days a week getting the same data that a service would provide weekly. Thus this data is costing only about $600 or less (figuring average scout costs of $1,200 to $1,500 a month) whereas with the service it will cost about $830.

Along with this the service doesn't and can't provide the extra bonus in added data and service.

Loyalty issue . . . Then, Garrison said, there is the question of loyalty.

"Who will the commercial service report to first when there is a major discovery? Who will be notified and how soon if a commercial service finds acreage open near a discovery?"

Poor salesmanship . . . Scouts generally do fine work—but they are very poor salesmen for themselves, Shamrock's Harry Britt said.

Britt, however, blamed the beachhead forged by commercial services on past poor performance by scouts in some areas. If the scouts had always performed the best they could, the services would never have gained a foothold.

Shamrock's scouts, he said, are doing top-notch work. "And I don't think any commercial system can provide me with the quantity and quality of data I need."

*Speaking is Sam Garrison, president of International Oil Scouts Association. At the head table, left to right, are Jack Wiggins, IOSA executive secretary; Bill Bailey, president of the Panhandle association; Harry Britt of Shamrock; Garrison; Wesley Weed, Sun Oil Co.; Wally Freeman, Sun; and B. P. Brown, Standard Oil Co. of Texas.

could not be obtained from the present commercial scouting services. It is doubtful, they say, if a company could get it anywhere else—but, if it could, it would be at very heavy cost.

. . . Workovers. Panhandle area scouts contend that well workovers, plug backs, drill deepers, etc., are either not covered or are only sketchily covered by commercial services.

They point out that a large percentage of all new reserves come from well workovers. A good scout check reports fully on all such operations.

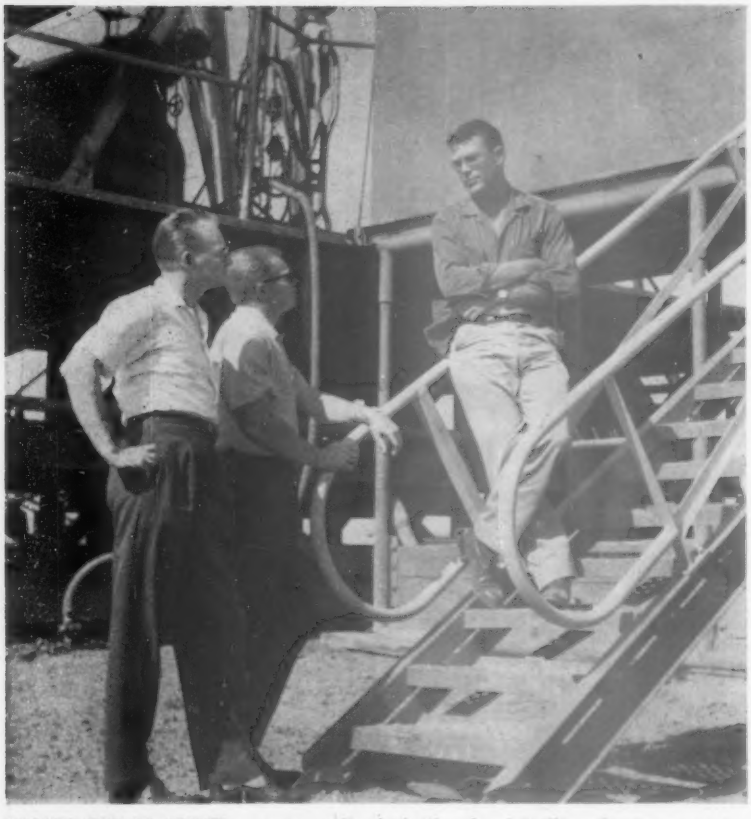
A geologist for another major in the Panhandle area confided that having complete workover data not otherwise available had many times influenced his company to keep acreage it had had for a long time rather than farm it out or release it.

"Workover data was all we had to indicate we weren't holding onto a white elephant. Now much of that land is producing."

. . . Tight-well deterrent. Scouts say a good scout check is a pronounced deterrent to operators drilling "tight" wells. They foresee a big increase in such drilling if the checks go out of business.

R. B. Totten, district geologist for Sun Oil Co. at Amarillo, agrees.

"The geologist feels like he is going to lose out. The tight-well situation is particularly worrisome to me. What lever would we have to get the dope from a tight well. The commercial



SCOUTS COLLAR DRILLER on new well which Blanchard Drilling Co. is preparing to spud southeast of Spearman in Hansford County in the Texas Panhandle. Scouts are Bob Wilson, El Paso Natural Gas Co., and D. L. Fahrny, Phillips Petroleum Co. Scouts claim information they pick up on rig floors can never be supplied by commercial scouting services.

services acknowledge the subscriber's right to drill a well tight and will not infringe on that right.

"With a commercial service then, we expect to see a big increase in the number of tight wells drilled. Why not? There's nothing to influence them not to withhold information. With the scout check, however, a company drilling too many tight holes can be threatened with expulsion or blacklisted."

... Company loyalty and extra effort. The Panhandle scouts argue the benefits operators get from these two factors cannot be measured in dollars. Many, many times, they say, these factors have brought an operator production and income far in excess of the cost of the company's share of check expenses and of operating its scout department for the firm's entire existence.

Likewise, companies constantly shell out thousands of dollars based solely on confidential data supplied by their scouts.

Here are some instances:

1. A major company, due solely to the work of one of its scouts, now has two rich gas-condensate wells in a Gulf Coast field. It values these wells at about $7,000,000 apiece. The scout in question hawked day and night the wildcat well which became the discovery in this field. He was able to get inside dope from a consulting-geologist friend hired by the operator drilling the well. He carefully made friends with landowners in the vicinity. He was on the well when it tried to blow out. He reported quickly to his company. The company was able to get landmen out and pick up acreage cheaply before the news of the discovery traveled any further.

2. Another operator spent more than $300,000 for leases in a new area when another company's wildcat struck oil. It was able to get the leases and get them cheaply because one of its scouts was on the rig floor when the successful drill-stem test was run.

3. Another company picked up a 2,500-acre lease for peanuts when its scout hurriedly phoned in after witnessing a core being pulled in a wildcat in West Texas. Today that lease is producing heavily after 11 years.

4. A major headquartered in Houston was highly interested early this year in a wildcat drilling for another operator in the Texas Panhandle. The company had no acreage near the test but was convinced that the well was on a structure. It didn't want to lease, however, without more information. One of its scouts haunted the well and was on site when the operator ran a drill-stem test in the Brown Dolomite. The scout had previously checked abstracts and spotted all open acreage. He immediately called his land department, and directed them to the open acreage.

The Houston company was able to round up more than 10,000 acres before its competitors knew what was happening. The wildcat potentialed 9,500,000 cu. ft. of gas a day.

5. A scout for still another firm was assigned to birddog a big potential acreage deal between two other operators in the Palo Duro basin. His company wanted to know the minute the deal was signed so that it could lease. The scout carried out this assignment perfectly. The company got a big jump on all other operators. And it ended up with acreage within 1½ miles in each case of 13 wells drilled by the buyer of the big spread.

Conversely, scouts save companies money as well as make it, the Panhandle scouts contend.

For instance, a large operator was preparing to submit a high bid for University of Texas wildcat acreage in West Texas. Another firm was drilling a tight hole in the immediate area. The first operator needed to know the results. Just before the sale, its scout discovered through a contact in the producing department of the "tight-hole company" that the latter was preparing to abandon the well. Result: The scout's firm saved a batch of money in refraining from buying costly leases nearby.

In another case, a scout was able to save his company a lot of money by calling in and stopping it from moving in a rig to drill acreage adjacent to a promising-looking wildcat. The rig-move plan was based on favorable drill-stem test data. The scout dropped by the wildcat, however, and discovered that the operator had perforated a false zone.

... Horse trading. Scouting's proponents also point out that—via the scout check and the cooperation that stems from it—an operator is able to get its hands on confidential logs, cores, and data from drill-stem tests that he could not otherwise get.

Operators also, through their scouts, can get early, valuable information on production for sale, shooting and seismic options, gas contracts, well samples, new operational methods, and a

from drawing board to installation . . .

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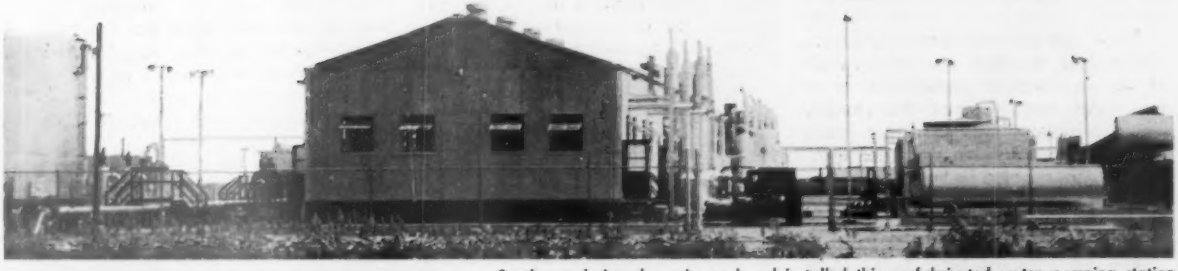
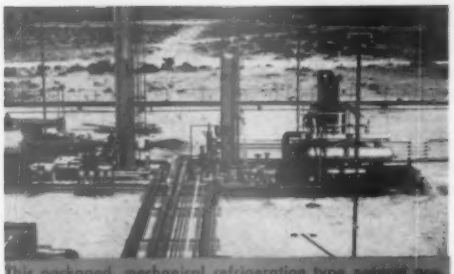


Southwest designed, engineered and installed this prefabricated water pumping station for a Pan American Petroleum Corporation unitized water-flooding operation in Southwest Texas.



This packaged, mechanical refrigeration type natural gasoline plant was built by Southwest on a turnkey contract that included complete process, design, and installation engineering for a major oil company in West Texas.

This barge-mounted compressor station, including dehydration facilities and incorporating 1600 h.p. of compression in four units, is utilized in offshore gas boosting to transmission sales by the CATC Group at Grand Isle, La.

In main line boosting for a major gas transmission company along the Texas Gulf Coast is this compressor station of four 660 h.p. packaged integral compressors, built completely on a turnkey contract.

Southwest incorporates engineered, pre-fabricated methods to install unitized facilities — *quicker and cheaper* — for the oil, gas and chemical industries on a turnkey basis. All are API-ASME code constructed.

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myriad of other phases of area activity.

... Assured accuracy. Finally, Panhandle scouts say, it is falacious to say that a commercial scouting service relieves a company of the clerical work of scouting.

They argue that the company, if it is to feel safe, must do this anyway to assure itself that it is getting complete and accurate information.

They contend commercial services are often missing new locations and completions and are minus much important information, such as core data and drill-stem tests, on some that are covered.

They charge that some operators which had dropped out of scout checks in favor of commercial services have now rejoined the checks. Their complaint was that they were not getting the information their geological departments had to have.

2. Cost Question

The Panhandle-Liberal scouts and their supporters hit hard at the idea that a commercial scouting service is cheaper.

They contend that the service will in reality cost a great deal more if the operator is to get from some other source everything he now gets from his scouts and scout check.

A service-subscribing operator will have to spend even more than before to assure himself that the information he is getting is complete and accurate. On top of this, he will have to spend a lot of money to get from some other source what he now gets from the scout check in the way of lease takeoffs, geophysical data, and workover information, the scouts charge.

A division production manager for a major company in the Panhandle area contends that even the cost of printed completion tickets is much cheaper now in his area via the check than a service could provide.

"This," he says, "is the item your contract services will furnish for some $800 dollars per month. Assuming that the companies keep their scouts on—which I feel absolutely necessary—here's an item that commercially costs $800, for which we're now paying less than $100."

"When you consider cost—and that of necessity is our first consideration in this day and age—the arrangement for commercial service will only cost more for what we're already getting. And it will fail to give us all the important extras that are frequently so vital to our operations.

"The scout office should be the nerve center of every operation. And I urge the scouts to wage a real fight to keep their organizations intact."

Mexican Gas Line May Bring

• Gas industry throughout the U. S. will feel effects of competition for supplies. It also promises to have a big impact on gas development and prices.

THE proposed $200-million pipeline to import U. S. Gulf Coast and Mexican gas into California could have far-reaching effects on pipelines serving both the West and East Coasts. And it could have a big impact on gas development in Mexico, Texas, and Louisiana as well as on future contracts and prices.

Here are some of the implications of the project involving Tennessee Gas Transmission Co.; Petroleos Mexicanos (Pemex), the Mexican government oil agency; and Southern California Edison Co., Los Angeles:

... Pipelines serving Midwest and Northeast U. S. markets from the Gulf Coast will have a new competitor for the supply.

... Producers will benefit from the entry of a new purchaser in the area who will offer a large market perhaps free of federal price regulation.

... Pemex will have the money and the incentive to exploit its relatively untapped gas potential in northeast Mexico.

... Northeastern U. S. markets now receiving some Mexican gas through Texas Eastern Transmission Corp. will have to compete with California for added supplies in the future. And California may have the advantage.

... Some $500 million in revenue might be realized by U. S. Gulf Coast producers over the 20 years as a result of selling gas in place for movement to California.

TGT confirms project . . . Some of these implications began to crystalize as a result of Tennessee Gas' first public admission that it has been working on a California pipeline since December 1957.

Since that date, the company has been the exclusive agent for Southern California Edison, Los Angeles electric utility, in obtaining a firm Gulf Coast gas supply to replace its interruptible supply from Southern California gas companies.

This was revealed by William W. Witmer, senior vice president of Tennessee Gas, and confirmed by Robert P. O'Brien of Southern California Edison in testimony before the California Public Utilities Commission.

Certain facets of the Mexican line have already been reported and verified in part by Pemex (OGJ, July 25, p. 131 and July 11, p. 62).

The scope of the project was detailed by Witmer for the benefit of the California commission which is considering a pipeline to import more Southwest gas into the state. The market for this added supply—from Colorado Interstate Gas Co. and El Paso Natural Gas Co.—is questioned in view of the Mexican proposal.

Mexican line details . . . Tennessee plans to build a 1,200-mile, 34-in. line from the Mexican border near McAllen, Tex., to Mexicali on the California border and on to Los Angeles area plants of Edison which is expected to agree on final details soon.

INDUSTRY BRIEFS . . .

Continental Oil Co. has developed a new additive, Adomite-Mark II, for improved fluid loss performance in fracturing. The company lists these advantages of the new additive: It gives reliable and predictable fluid loss control in all oils; its fluid loss properties are not appreciably altered by changes in temperature, pressure, or viscosity; and it will tolerate up to 20% water in the fracturing oil without bad effects.

Apache Gas Products Co. of Tulsa, wholly owned subsidiary of Apache Corp., has bought the interest of Walter B. Moran and associates in a gasoline plant at Kendrick in East Central Oklahoma. Co-owner of the plant is Warren Petroleum Corp. It will be operated by Apache with Warren continuing to market the products. The plant processes 16,000 to 18,000 M.c.f. of gas daily, producing about 25,000 gal. of liquids.

Vickers Refining Co. of Wichita, Kans., has restored a 7-cent per barrel price cut on about 5,000 bbl. daily of crude it buys in Kansas. The new

Vast Changes

Pemex would own the Mexican section, which would be financed by 20-year revenue bonds as opposed to conventional pipeline mortgage bonds. Pemex would own the line free of debt after 20 years. Tennessee would service and maintain the Mexican section for Pemex. The Mexican section would cost $160 million; the California section $40 million. The system when fully powered could carry 750,000 M.c.f. daily.

Supply . . . Tennessee plans to export from the U. S. 335,000 M.c.f. daily which it will purchase or take for the account of Edison.

The U. S. gas will be delivered into the Mexican line along with at least 75,000 M.c.f. daily to be purchased from Pemex at the Reynosa gasoline plant in the McAllen vicinity. Pemex may furnish up to 200,000 M.c.f. daily depending on availability.

Deliveries to Edison are to start at 225,000 M.c.f. daily, building to 410,000 M.c.f. daily at the end of the fifth year.

The U. S. supply is to be delivered through Tennessee's system between McAllen and Louisiana which now moves gas Northeast but would be reversed under this proposal. Gas purchased for the Mexican line would actually go into Tennessee's system to Midwest and Northeast markets. The gas already committed to Tennessee on the lower part of its system would be shifted to the new project.

U. S. in-place sales . . . Witmer said that most of the U. S. gas has been obtained and the remainder could be signed up quickly.

Some 2½ trillion cubic feet would be required for the volumes mentioned by Witmer. The biggest single supply is expected to come from the Bastian Bay reserves of Pan American Petroleum Corp. which could provide almost half of the total.

William W. Witmer
. . . Details TGT gas plans.

The sale is expected to be an "in-place" type of deal with a flat price for the gas giving Edison a firm price over the life of the reserves at 20 cents an M.c.f.—the minimum price expected. Suppliers could realize $500 million from all sales for California (A single sale of this type to Texas Eastern involved about $100 million).

When asked whether Bastian Bay were included in the supply package, Witmer declined to say on grounds he would tip his hand to his competition. However, the proposed deal has been talked in the industry for more than a year.

Mexican gas . . . Witmer said the project would have available tremendous reserves in northeast Mexico.

He compared the Reynosa district with the adjoining Texas Railroad Commission District IV in South Texas which is the same geologically. He said in District IV there have been some 25,000 wells drilled and about nine trillion cubic feet of gas proved. In the Reynosa district, which is larger in area and has the same productive sands, there have been 500 wells drilled and three trillion cubic feet of gas proved.

In view of the California project, Witmer said Pemex has stepped up drilling in northern Mexico. He said the deal with Pemex was such that the Mexicans would find it very attractive to commit more gas to California. Pemex would not only benefit from the sale but would also receive transportation revenue for moving the gas to California.

Hence, Tennessee might be in a better position to bargain for future reserves than Pemex' existing U. S. customer—Texas Eastern—which has contracted for some 200,000 M.c.f. daily from the Reynosa plant.

Pacific Lighting position . . . Where does this project leave the Pacific Lighting Corp. subsidiaries in Southern California which now supply gas to Edison?

It apparently means that if the Mexican project is built the companies can expect to lose virtually all their biggest single load within 5 years of the startup of the Mexican line scheduled for July 1, 1962. That is the date that Pacific Lighting's contracts with Edison expire.

Edison has total fuel requirements on a gas basis of 350 to 360 million cubic feet daily, supplied in part by fuel oil. These requirements will increase by 1975 to about 875 million cubic feet a day.

As deliveries through the Mexican line increase, take from Pacific Lighting would decrease.

---

top posting is now $3.05. Vickers Refining President J. W. Meehan said the "increase has been made possible by some long overdue gains in refined product prices."

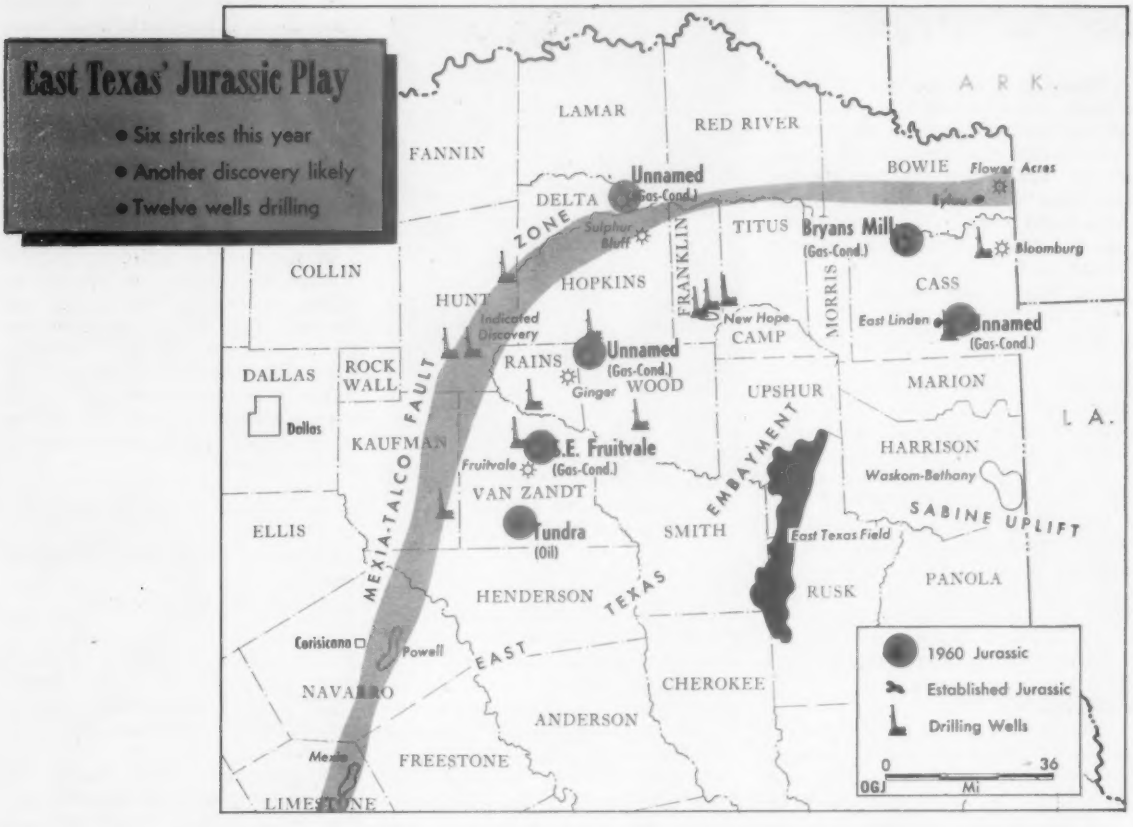
Peoples Gas Light & Coke has asked FPC approval of a $23,700,000 expansion plan for two subsidiary companies. The project would increase capacity of Peoples Gulf Coast Natural Gas Pipeline to 669 million cubic feet daily and capacity of Natural Gas Pipeline to 870 million cubic feet daily.

El Paso Natural Gas Products Co. will expand the Odessa styrene plant from 60 million to 80 million pounds per year using the UOP Alkar process. Completion is expected late this year.

Stockholders of Kinney-Coastal Oil Co., Denver, will vote August 19 on Ohio Oil's offer to buy certain assets of the company for $1,629,000 cash and an oil and gas production payment of $7.3 million. The sale has been approved by Kinney-Coastal directors.

Continental Oil's new electrochemical system for controlling corrosion, trademarked "Anatrol," will be manufactured and marketed by Minneapolis-Honeywell Regulator Co. under a world-wide license agreement. Conoco scientists developed the system which controls corrosion in the storage and processing of acids and caustics.

CATC has completed a $1,300,000 short-cycled adsorption-type gasoline plant at Grand Chenier, La. The plant, largest of its type, has an initial capacity of 175,000,000 cu. ft. daily of gas from CATC's East and West Cameron fields 30 miles offshore. Delta Tank Manufacturing Co. was the contractor. Continental Oil is operator for the CATC group which also includes Atlantic, Tidewater, and Cities Service.



Jurassic Wildcatters Scoring Regularly

• This will be the best year yet for the Jurassic play in East Texas. Six fields have been discovered and a seventh looks assured. And drilling is at an all-time peak with 10 wildcats and two development wells under way.

EAST TEXAS wildcatters are stepping up their hunt for the potentially rich but elusive oil and gas production in the deep Jurassic horizons.

Opening of two additional Jurassic fields the past week raises to six the number that have been found so far this year in the district. With nearly a half year of exploration remaining, this is double the number discovered in any previous year. Only one was found in 1959.

Already oil and gas showings encountered in another of the growing list of Jurassic-found wildcats drilling in East Texas have given virtual assurance of an additional new field.

Ten wildcats and at least two additional exploratory field wells are now drilling with the deep Jurassic horizons as their objective. This is the greatest array of Jurassic drilling in the district at any time on record.

Latest of this year's six new Jurassic fields is a discovery by Happy Gist and Pan American Petroleum Corp. in Cass County, on the eastern edge of the district bordering Louisiana.

This is a dual discovery with production both from the Cotton Valley, uppermost Jurassic member, and the deeper Smackover formation. It is the first East Texas Jurassic field to produce from both horizons. Another Jurassic discovery was dually completed but both zones were in the same formation—the Cotton Valley.

Virtual assurance of another new Jurassic field is given in testing now under way in a wildcat 25 miles farther west in southern Hunt County. This wildcat, Paul C. Teas' 1 J. H. Chambliss, flowed gas and condensate in a preliminary drill-stem test of Smackover lime at 8,970-9,000 ft. Since then hole has been deepened to 9,100 ft. and casing run for production tests.

Its location is 4 miles north of Quinlan, about 1½ miles south of the Ashby-Ramsey field, productive from Woodbine sand below 3,200 ft.

If it makes a well, it will be the first Jurassic production in the county, located on the far-northwest bend of the Mexia-Talco fault zone.

Recent success . . . The Gist and Pan American discovery well (1 Grant Unit) is productive of gas and condensate.

From the deeper Smackover zone, perforated at 11,125-32 ft., 11,140-50 ft., and 11,170-74 ft., it tested 382 M.c.f. of gas daily, flowing through ⅜-in. choke. Its 55.6°-gravity condensate recovery was at the rate of 37.49 bbl. per M.M.c.f. Its Cotton Valley zone, perforated at 10,981-88 ft., flowed 147 M.c.f. of gas and 19 bbl. of 54.7°-gravity condensate in a

(Continued on page 101)

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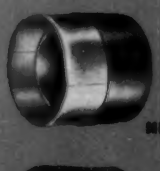

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60—846

How one operator used D-Gassers to

reduce gas well costs by about $55,000

A Canadian operator — drilling deep gas wells in the Alberta foothills — is using the SWACO D-Gasser to save about $55,000 per well. Here is how he does it:

This operator, who was developing a gas field in the Alberta foothills, was encountering a gas-cutting problem during drilling that increased costs seriously. The problem was high-pressure, low-volume gas accumulations in a shale section above the main pay or between pay zones.

Until this shale section was reached, mud weight of 10 pounds per gallon was carried. When this section was being penetrated, however, severe gas cutting and "blowing" occurred. The gas cutting then persisted in the form of a two to three hour trip gas for the remainder of the well.

Practice before using D-Gasser

The operator circulated until he could build mud weight up to 11-13 pounds per gallon to control the gas cutting. Lost circulation in the pay section frequently occurred with the heavy mud, and a great deal of lost circulation material was often required. The cost of mud materials to control both gas and lost circulation ran $25,000 or more per well.

Initially, it took anywhere from two days to a week to condition the mud, and in one case it was necessary to set casing before drilling could proceed. In addition, several hours of rig time were lost after each trip gunning out the trip gas.

Practice when using D-Gasser

With a D-Gasser installed, the operator merely starts it up when the gas cutting occurs. Occasionally the preventers have to be closed, and the well placed on choke for a few hours. However, the whole job of mud conditioning can be accomplished in less than one day without increasing the mud weight. Moreover, penetration rates and bit life while drilling using the lower weight muds are substantially improved. Total savings in drilling costs amount to approximately $30,000 per well.

To summarize, the operator has found he saves $25,000 or more in mud costs and something like $30,000 in rig time and other drilling costs.

This case is just one of many examples that prove the SWACO D-Gasser is more than just a safety device to be used for wildcat drilling. It makes possible important reductions in overall well costs in any area where gas cutting is a problem. Contact your nearest SWACO representative to find out just how much D-Gassers can reduce your costs. Also ask him how SWACO Clayjectors and D-Sanders can further reduce drilling costs.

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COLORADO: Durango

(Continued from page 98)

5-hour test through ¼-in. and ½-in. chokes.

It is significant that the gas from the Cotton Valley zone is sweet. Gas production from most East Texas Jurassic discoveries so far has been sour.

Location of this well is 2½ miles southwest of Bivins, after which it may be named. It is slightly less than 3 miles east of a Jurassic field (East Linden) discovered by Pan American a little over a year ago as the only Jurassic field found in East Texas in 1959. East Linden, which now has three wells, is oil productive from the Cotton Valley formation. The discovery well was dually completed with two zones in that formation. East Linden is one of the few so far in the district with oil production. Most of the fields produce gas and condensate.

Just slightly more than 1,600 ft. southwest of the new Gist-Pan American discovery, Sunray Mid-Continent Oil Co. is coring ahead in the Jurassic in a test (1 Grogan) started before Pan America's well had given indication of production. Its cores in the Cotton Valley have had fair odor and some fluorescence.

Pan American is the operator on the other new Jurassic field opened during the week. It is in the northwest corner of Wood County, nearly 80 miles west across the East Texas salt basin from the Bivens discovery. There, the discovery well, 1 McKee, flowed at the rate of 9,100 M.c.f. of gas daily through 32/64-in. choke, with recovery of 121 bbl. of 60.5°-gravity condensate per M.M.c.f. Its pay is the Smackover with perforations at 12,765-95 ft.

Development of the new field, 4 miles northwest of Yantis, already is under way with an offset and confirmation well, 1 M. S. Neindorff, drilling 3,500 ft. northeast.

Early play . . . Seventeen Jurassic fields have been discovered so far in East Texas.

The first field was found in 1944, but it was not until a rich gas-condensate discovery was made at New Hope, in Franklin County, in 1953, that much serious consideration was given to the Jurassic potentialities. Operators had been more concerned with exploration and development of the more extensive and possibly more prospective shallower Cretaceous horizons.

The East Texas play is an extension of the much more extensive and older Jurassic development that has spread through southern Arkansas and northern Louisiana. Most of it stretches around the north and west rim of the large East Texas salt dome embayment, roughly following along and basinward the skirting Mexia-Talco fault zone.

Present fields are scattered around that trend a distance of more than 200 miles from the most northeasterly fields (Eylau and Flower Acres) updip on the fault zone near the Arkansas line, to the most southwesterly field at Mexia, in Limestone County.

So far only a few of the Jurassic fields have had more than one or two wells. Most extensive development has been at New Hope field and in the Waskom-Bethany area. New Hope, one of the more basinward fields with production from the Smackover at depths below 12,000 ft., has more than 15 wells. The Waskom-Bethany area along the Louisiana border in Harrison and Panola counties, had the first production in the state from the Cotton Valley formation. This is gas from 8,500-ft. depths. Eleven wells have been completed so far on the Texas side.

Five East Texas Jurassic fields produce from the Cotton Valley horizon. Twelve produce from the Smackover. One is completed in both zones. Another produces from an upper Jurassic zone believed to be the Buckner.

Only four of the fields so far have been oil-productive. These include the initial discovery in 1944 at Eylau, just inside the Texas line. In two of these the pay is Cotton Valley formation. The others produce from the deeper Smackover zone.

One of the oil fields, Tundra, in Van Zandt County, is among the 1960 discoveries. Opened last July, it is productive from a 10,670-ft. Cotton Valley zone.

Gas Detector Needs No Power

• The device only needs an energy assist after it is tripped to sound an alarm, or start a ventilator.

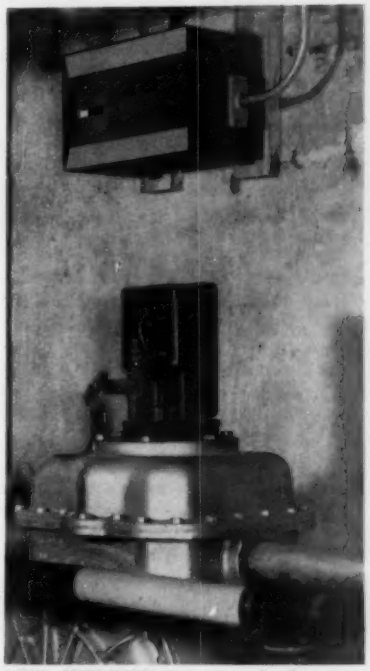
A NEW INSTRUMENT can detect minute quantities of methane and many other gases without any assist from outside power, the maker claims.

The device monitors density of the air in the area where it is installed. Essentially, it consists of a sealed container of dry nitrogen counterbalanced to float in gas-free air. When the air is diluted by small amounts of any gas whose density is substantially different from that of air, the balance is upset.

As the float sinks or rises, according to the kind of gas diluting the air, it closes small mercury switches. These switches can sound alarms, flash lights, start ventilating fans, or even dial a prearranged phone number.

Detectogas Instruments, Inc., of Houston, which holds patents on the device, says that it uses no power as long as it is simply monitoring and no gas is present. Only when there is gas and the instrument trips is power needed. This current may be supplied by batteries, or commercial power may be used.

Compensating devices, Detecogas says, offset the effects of temperature, atmospheric pressure, and humidity on the density balance. And, the firm claims, there are no hot wires, rotating parts, or complicated switchgear to fail. The company says it expects to find a market in all branches of the industry.



NEW DETECTOR (at top of photo) is actuated by changes in air density.

The detectors are being manufactured by Texas Instruments, Inc., for Detecogas and are available at a price said to be less than $1,000 per unit.

Canadian Gas Imports Still Need One Approval

- **Plans to bring Alberta gas to the West Coast clear the FPC. California's approval is still needed.**

THE FEDERAL Power Commission has authorized the importation of more than 500 million cubic feet daily of Canadian natural gas into the U. S. to supply markets in California and the Pacific Northwest.

The importing companies are Pacific Gas Transmission Co., El Paso Natural Gas Co., and Montana Power Co.

Pacific Gas Transmission will build a 614-mile line from the Canadian border to the California border to supply Pacific Gas & Electric Co. The subsidiary will distribute the gas in California.

PGT will also build a 105-mile line from the Canadian border to a connection with El Paso, which will take the gas to the Spokane area for delivery into its general system supplying the Pacific Northwest.

Montana Power Co. will be delivered gas at the Canadian border by its subsidiary, Canadian-Montana Pipe Line Co. The gas will then be piped to Montana Power Co.'s facilities at Cut Bank, Mont.

All of the projects will draw their gas from Alberta fields and it will be brought to the border by Alberta & Southern Gas Co. facilities. The exports were approved by the Canadian Government in the spring (OGJ, Apr. 11, p. 83).

However, there is one more approval to win before the interlocking plans of the various companies can be carried out. This is the blessing of the California Public Utilities Commission for the PG&E line from the northern border of the state to San Francisco.

The final clearance from the Californias commission is expected soon. Should the decision be delayed, construction work on the projects may have to wait until after the winter.

Examiner overruled . . . In granting the certificates, the FPC eased some of the conditions proposed earlier by an FPC hearing examiner.

The examiner had specified that both the U. S. importers and Canadian suppliers keep the commission informed on price factors so that the U. S. consumers could be protected from possible sharp increases in the cost of gas in Alberta after service had begun.

His proposal was criticized sharply by some Canadian authorities, who read into it an effort by the U. S. agency to control gas prices paid to Canadian producers.

The incident spotlighted the fact that there is no international agreement between the two countries to provide means for settling price or supply disputes should they arise.

However, the commission did not adopt the examiner's proposal. Instead, it simply specified that the three U. S. companies file annual reports showing monthly and peak-day volumes and average monthly prices of the imported Canadian gas.

The commission reasoned that it would not be necessary to require reports from the Canadian companies because the U. S. firms doing business with them would be able to supply any necessary data.

The FPC authorizations also included the additional conditions that PGT file a report of its financing program and that its tariff be based on a rate of return of not more than 6¼%. The company had proposed a rate of 6½%.

Grand Canyon Leasing Denied

HOPES for the issuance of oil and gas leases in the Grand Canyon National Game Preserve have been killed temporarily by opposition of the Arizona Game and Fish Commission and sportsmen in the state.

The anti-leasing views were given at a hearing in Phoenix held by Fred H. Kennedy, regional forester. Texas Oil Co. of Texas and New Mexico, argued that none of the natural values of the area, commonly known as Kaibab North, would be damaged by exploration activity.

Kennedy withheld a decision following the hearing but expressed hope that "we can get together and find out if there is oil or gas on the Kaibab." He indicated he might favor a few test wells prior to any large-scale leasing.

The Arizona Game Protective Association unanimously adopted a resolution which states that leasing and drilling would be detrimental to the area. The Game and Fish Commission said the oil-company proposal is objectionable and "for the present time (the commission) stands opposed" to the leases.

Speaking in favor of the proposal, besides Texas Oil, were Ernest Chilson, Flagstaff, a member of the Arizona Oil and Gas Commission, and Jay Whiting, lumber operator on Kaibab North.

Coal Wants Resid Quotas at 1957 Level

THE NATIONAL Coal Policy Conference last week made a final, last-minute effort to persuade the Interior Department to hold fourth-quarter residual fuel-oil import quotas to 1957 levels of about 400,000 bbl. daily.

This would be as much as 150,000 bbl. daily below what some oil officials have said would be needed to avoid fourth quarter shortages.

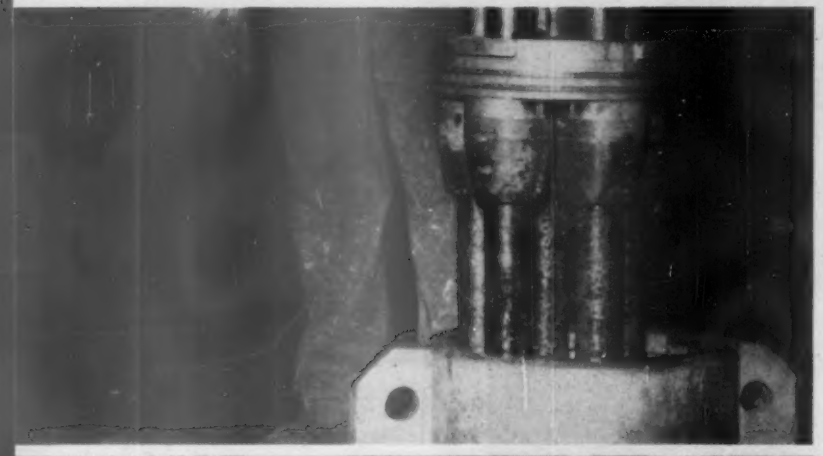
Aware that Interior was planning to announce fourth-quarter quotas by August 15, NCPC last week wrote Interior Secretary Fred Seaton contending that total fourth-quarter demand would be no higher than in 1957, the base year for the residual import program.

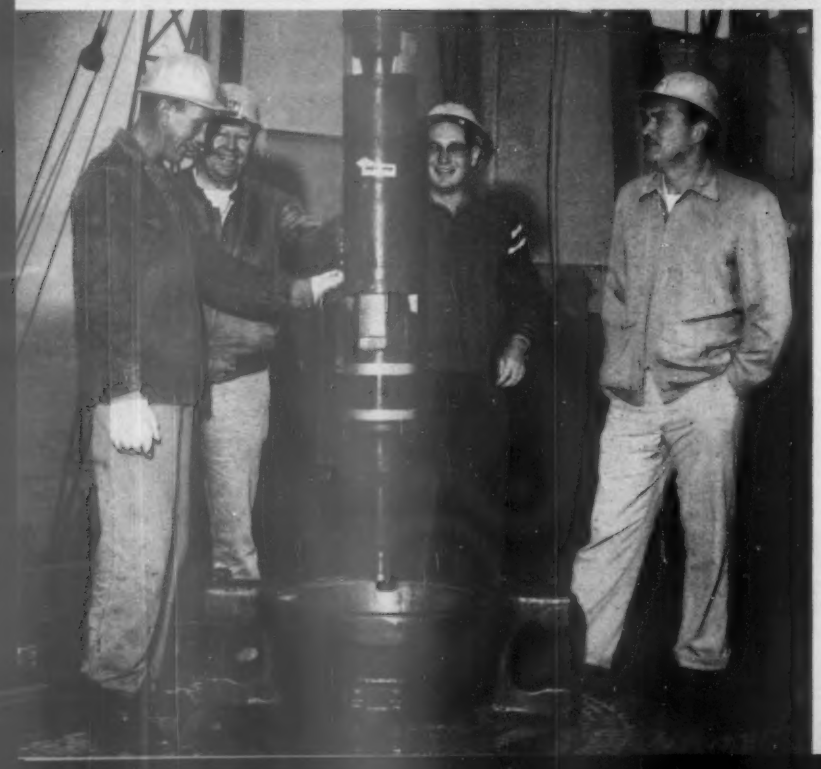
NCPC said the 400,000 daily quota would insure an adequate supply for the East Coast "unless the program is sabotaged by the dumping of residual oil at less than posted prices to users equipped with multiple burning facilities."

In the fourth quarter of 1959, residual imports averaged 434,414 bbl. daily, according to Oil Import Administration records. Furthermore, some importers have pointed out, the low quota for the current quarter (250,000 bbl. daily) has not made possible the normal buildup of stocks during a period of off-peak demand. Therefore, they say, quotas for the fourth quarter should be high enough to offset this.

Any demand increase, the NCPC told Seaton, is offset by decreased demand in four categories—industrial use, oil refinery use of resid as fuel, non-bonded bunker fuel use, and military consumption.

FIRST FIVE-STRING COMPLETION . . .





Sinclair Oil and Gas Company recently completed the world's first quintuple string producer. OCS 0439, Well #6, Block 190 field, Eugene Island area, Offshore Louisiana, is the first well in the petroleum industry to produce five zones simultaneously from one well through five strings of production tubing. The participants are: El Paso Natural Gas Company, Peoples Production Company, Sinclair Oil and Gas Company and Sohio Petroleum Company.

When this well was raising questions about equipment, we had the answers on packers. A Brown H-S hydraulically-set retrievable five string packer had already been built and tested—was actually waiting for the well we knew would eventually need it. Our other packers in this completion and the Brown multi-string slips and elevators used to run them have taken many kinks out of the tricky but profitable multi-zone completions. Sinclair's five-string is the latest success in a development program which has made Brown the leader in production tools for over a quarter of a century.

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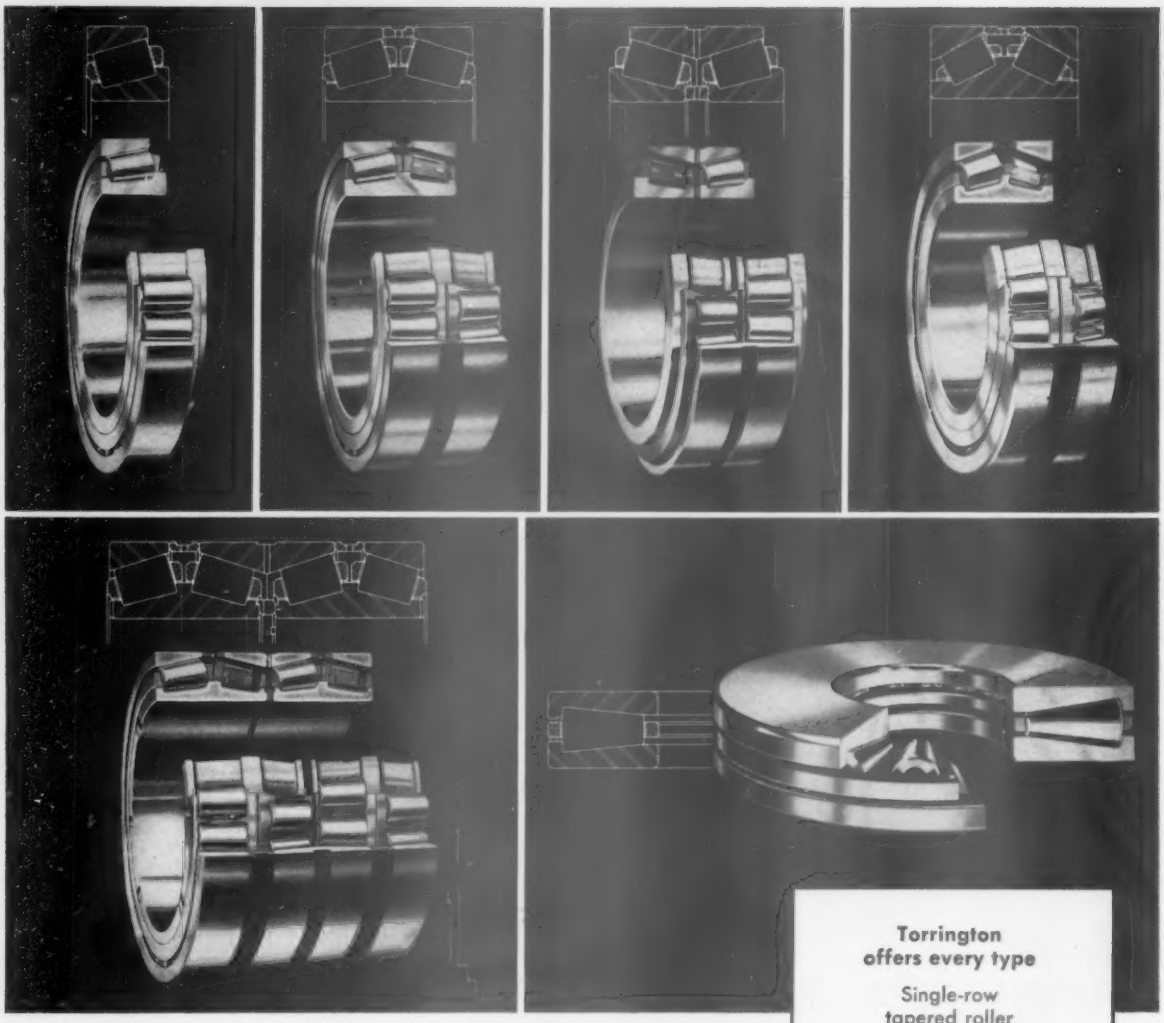

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Another Company Jumps into Petrochemicals

- **Sunray Mid-Continent forms chemical subsidiary to handle research, manufacture, and sales from present processing units. Quick expansion planned into other lines.**

SUNRAY Mid-Continent Oil Co. has completed plans to enter the chemical field on a broad basis.

Chairman R. W. McDowell and President Paul E. Taliaferro last week announced that Sunray Chemical Co., a subsidiary, will be organized to conduct chemical and petrochemical research, manufacturing, and sales. Headquarters will be in Tulsa.

President of the chemical firm will be Glenn E. Wynn, who will resign as president of Suntide Refining Co., Corpus Christi, to head the new project. Suntide also is a wholly owned Sunray subsidiary.

McDowell explained that Sunray Mid-Continent's three refineries at Tulsa, Duncan, and Corpus Christi, plus numerous field gas and gasoline extraction plants, give the company an excellent springboard into petrochemicals.

He also reported that no limits on activities of the new chemical venture had been placed by company directors when they approved plans for aggressive entry into thhe field. He said the action stemmed from the company's determination to expand and grow wherever there were new opportunities for profit.

Sunray already is producing several petrochemical intermediates. These include tetramer, benzene, toluene, xylene, paraxylene, and orthoxylene. A new Udex unit is scheduled for completion in October at the Tulsa refinery.

A multimillion-dollar program was announced recently for the Suntide plant to build styrene and hydrodealkylation (Hydeal) units.

These units will make additional basic intermediates used for producing organic chemicals, pharmaceuticals, plastics, plasticizers, elastomers, synthetic fibers, and synthetic rubber.

McDowell said the company hopes to build or acquire other facilities to produce polyethylenes, polypropylenes, naphthalenes, and carbon black. These petrochemicals will be marketed to firms who manufacture light weight synthetic wrappings, plastic dishes, dinnerware, novelties, and a host of other items needed both for industrial and general consumer markets.

Dry Holes Dot Los Angeles

THE TOWN-LOT drilling play in metropolitan Los Angeles turned up three dry holes last week, but another try at this expensive, soundproof-type exploration is about to get under way.

The dry holes were reported by Standard Oil Co. of California, Mobil Oil Co., and Humble Oil & Refining Co.

While these failures were reported, Continental Oil Co. announced plans to drill a fourth well on an 800-acre lease which includes the Metro-Goldwyn-Mayer movie lot and the Desilu TV lot.

Dry holes . . . The Socal well, 57-1 Southern Pacific, is near the heart of Los Angeles. It is located at Seventh Street and Alemeda Avenue.

The operator had scheduled the well to 10,500 ft., but is abandoning the well at 9,524 ft. Nearest production is 1½ miles to the southwest.

The Mobil well is one which has been closely watched for several weeks. The test (1 Brentwood) was drilled on the Brentwood Country Club in suburban Santa Monica.

The wildcat was drilled to 11,136 ft. It is the first test of a 143-acre lease Mobil holds on the country-club grounds. The company probably will drill another well, but no plans have been announced.

The Humble dry hole, Rosemead Oil Unit 1, went to 7,713 ft. This well is east of Los Angeles on the San Bernardino Freeway near Rosemead Boulevard.

Conoco test . . . The Continental well is part of a development program on the M-G-M-Desilu lease.

Conoco came up with a 720-bbl. daily discovery on the M-G-M lot in its first test, the M-G-M 1, but two other slant holes drilled from the site were dry. The fourth well, Culver City unit B-4, will be bottomed about 4,000 ft. southeast of the discovery.

The new test is projected to the productive zone found in the discovery. The M-G-M 1 was drilled to 11,128 ft., but plugged back to 8,807 ft. The flow was through a restricted choke from a perforated interval at 8,660-8,807 ft.

The Culver City play is west of metropolitan Los Angeles and on the northwest edge of Inglewood field. About 3 miles to the north, Signal Oil & Gas Co. and Richfield Oil Corp. have a highly successful town-lot drilling program on two golf courses.

Humble's Label Going on All Stations

HUMBLE Oil & Refining Co. is still not ready to announce its nationwide brand name, but it is preparing to make the Humble name familiar everywhere.

The company said last week its decision to place the Humble name on the facades of all its service stations cannot be interpreted as a decision to eventually substitute Humble for such well-known names as Esso, Carter, and others long used by Standard Oil Co. (N. J.) affiliates.

When New Jersey merged all its domestic companies into the new Humble organization last year, the company said it intends to market in all 50 states under a single brand.

Humble currently is marketing in 37 states and is moving into others. All its divisions are using the "Happy Motoring" slogan and the "Happy" oil drop symbol, and, with the addition of the Humble name, the stations will be further identified as corporate brothers.

Humble divisions are now using such names as Humble, Esso, Carter, Oklahoma, Pate, and Enco. The Enco name recently was adopted for stations in the northwest. Jersey is prohibited by court order from using the Esso name in certain areas.

Thompson's View: High Runs Rock Stability

• Chairman of Texas Railroad Commission says refiners' continuing policy of high runs is "incomprehensible." And Texas, he says, is bearing the brunt of high runs by cutting back crude production to all-time lows.

GEN. E. O. Thompson, chairman of the Texas Railroad Commission, took off the kid gloves last week and slugged away at refiners' irresponsible inventory management.

In a report he called the "Incremental Barrel," Thompson termed it "utterly bewildering why the oil industry is continually in the process of either building up excess inventories or attempting to work them off.

"There just never seems to be any protracted period when supply is maintained in line with demand requirements. By contrast, the steel industry has no compunctions about holding its operating rate at 50% of capacity or below, if the situation so warrants."

The root of the trouble, Thompson said, is the surplus refinery capacity encouraged as standby capacity by government offers of accelerated tax amortization. The added capacity was built but has been used to flood the market with gasoline rather than remain in standby for emergency use.

This is a problem, Thompson said, that is unstabilizing a great industry. "The public cannot understand this problem. But security analysts do understand it."

As evidence of this understanding by financial circles, Thompson quoted a report presented in December 1959 by the Investment Bankers Association of America:

"Continued lack of inventory control will further reduce the attraction of oil securities, and, consequently, make future oil-industry financing more difficult and costly. We believe it is the responsibility of investment bankers in their contacts with oil-company managements to press the fact that the investor also is greatly concerned with lack of inventory control and the industry's generally poor earning trend."

Action "incomprehensible" . . . Refiners' actions in maintaining high runs become even more incomprehensible in the light of domestic crude-oil statistics, Thompson said.

"The Texas Railroad Commission took a constructive attitude on setting allowables for the month of July. Allowables for that month ran about 47,000 bbl. daily below June 1960 and 70,000 bbl. daily below July 1959. For August we continued a strict 8-day allowable due to excessive products stocks on hand.

"Texas has borne the brunt of adjusting production to existing market demand over a period of years."

The state has accounted for as much as 44.7% of total United States production in the past. In recent years, Thompson said, there has been an almost continuous decline.

During the first 7 months of 1960, he said, Texas hit all-time lows in:

. . . Number of producing days, with only 63 as compared with 77 in the corresponding period of 1959.

. . . Share of U. S. market, with only 36.8%.

The Texas commission, Thompson said, has kept the Texas crude inventory in good shape. "We have allowed to be produced all the oil that would be brought ratably among all the 6,000 oil fields of Texas with her 196,000 producing oil wells."

"We must always look to inventories of products (in setting crude allowables) because products are ground up crude in fact. We cannot prescribe how much runs through still shall be, and we have no desire to do so. But we can consider the wasteful results . . ."

How Texas Is Holding the Line

Allowables are down for the year

Thousands of barrels daily

State—	July 1960	June 1960	July 1959	Change, July 1960 over: June 1960	Change, July 1960 over: July 1959
Texas	2,597	*2,644	2,667	−47	−70
Louisiana	963	938	902	+25	+61
Oklahoma	488	507	525	−19	−37
New Mexico	353	349	347	+ 4	+ 6
Kansas	293	293	312	0	−19
Total	**4,694**	**4,731**	**4,753**	**−37**	**−59**

*Week ended June 18.

Producing days are at all-time low

Figures cover first 7 months of each year

Month—	1960	1959	1958	1957	1956
January	10	12	12	16	17
February	10	11	11	15	16
March	10	12	9	18	17
April	9	11	8	16	16
May	8	12	8	16	16
June	8	10	8	15	15
July	8	9	9	13	16
Total	**63**	**77**	**65**	**109**	**113**

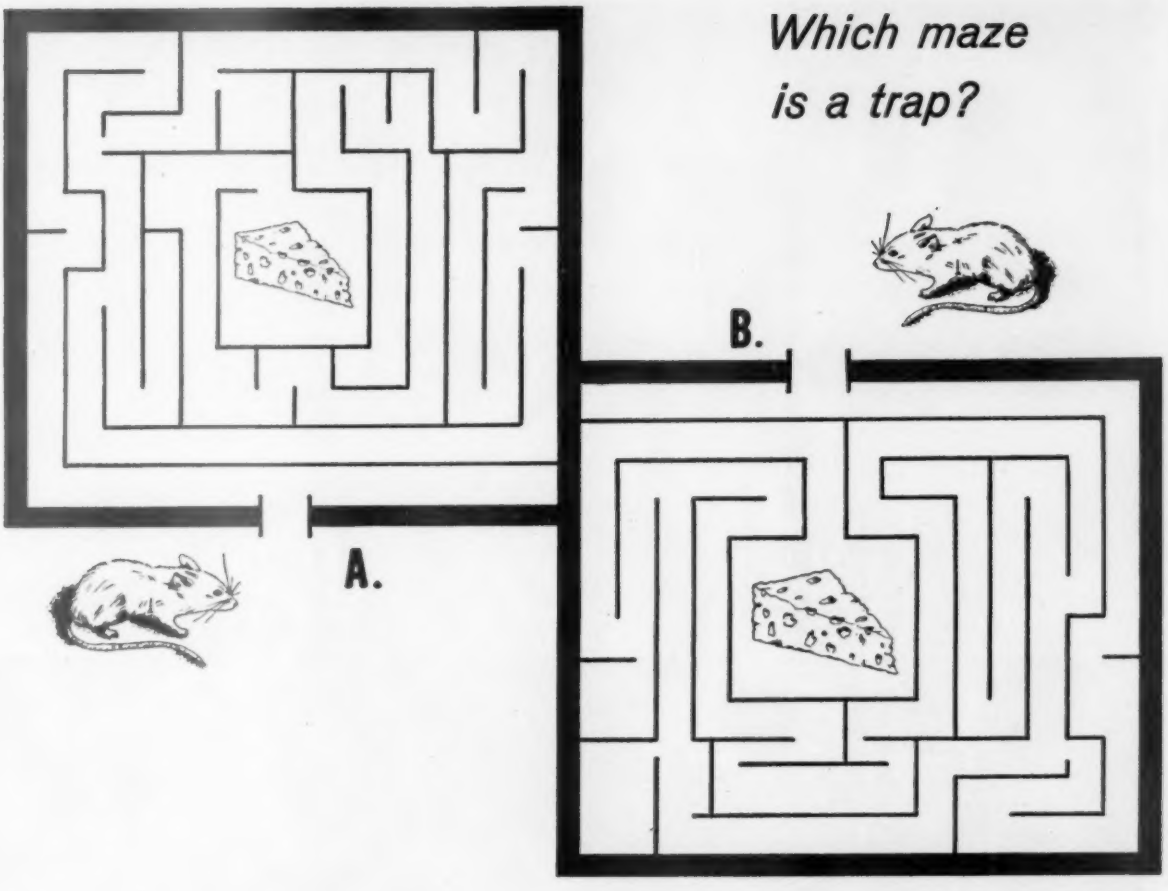
King Ranch Storage Planned

HUMBLE Oil & Refining Co. last week sought a permit from the Texas Railroad Commission to store LPG in three nonassociated gas reservoirs in Borregos field of Kleberg County.

The products would come from the big new King Ranch gasoline plant. Humble plans to store the liquids until the purchaser is ready for them.

Meanwhile, Humble told the commission, the plant can begin operations and sell gas to industrial customers.

The reservoirs involved are the D-5, the H-7 South Zone, and the H-5. Each of the pools has one completion but none has produced. Humble plans to use the 4,700-ft. D-5 reservoir, which takes in 3,105 acres, for storing butane only. It would use the 5,100-ft. 2,338-acre H-5 zone for propane, and the 5,175-ft., 1,487-acre H-7 South Zone for ethane.



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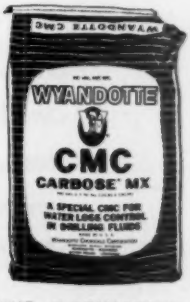
ANSWER: If mouse A uses his head, he'll stay out of that maze of blind alleys. If mouse B follows his nose, he will eat.

* * * * *



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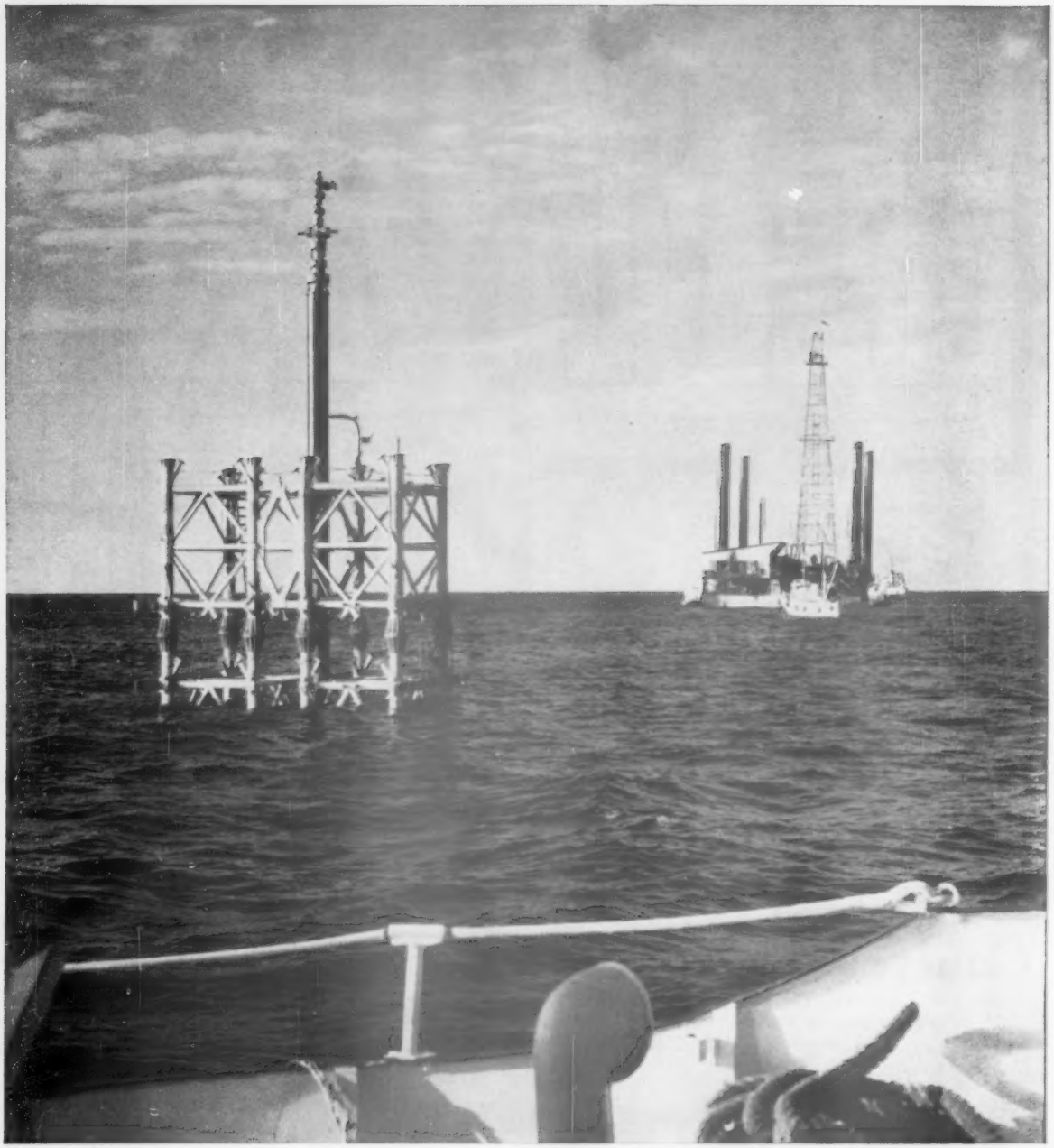

ABU DHABI

A well head in the Persian Gulf. In the background, the barge "Adma Enterprise" which is currently drilling beneath the waters of the Gulf. The results are sufficiently encouraging to warrant the preparation of facilities for regular production. This stage should be reached by mid-1962.

BP

Venezuela Takes A Rosy View of Oil's Future

• The country's new 4-year plan anticipates a 4% annual increase in oil production, which would be a complete reversal of the present trend.

VENEZUELA may be building its ambitious new 4-year plan for the country's economic growth on a shaky foundation—a weakened oil industry that owes its present feeble condition to government policy.

The whole object of the new 4-year plan is to "sow the oil" profits and plant a new and more diversified economic crop for the country's future growth. The plan was first outlined by President Romulo Betancourt several weeks ago. Recently Dr. Manuel Perez Guerrero, director of this master plan and head of Betancourt's office of coordination and planning, explained it more fully and in concrete terms.

Here are the basic numbers involved in Dr. Perez's July 1960 to July 1964 plan:

... **Income** of Bs. 26,000,000,000 (about $7,800,000,000) with the bulk of that money to continue to come from the country's oil industry as it has for years.

... **Expenditures** of Bs. 22,800,000,000 (about $6,850,000,000) to run the government, put new life into industry (other than oil), agriculture, and the general economy.

The big apparent hitch in this nice balance is that expected income over the 4-year period is based on an anticipated 4% annual increase in the country's oil production and assumes that all this increase will be sold at posted prices.

The 4% annual increase seems to be the magic number among Venezuelan governmental experts. It is the one mentioned frequently by Dr. Juan Pablo Perez Alfonzo, the country's minister of mines and hydrocarbons. Dr. Perez Guerrero said a few days ago that the expected 4% increase is regarded as "conservative."

If Venezuela's oil industry does maintain this steady rate of growth, it will have to reverse its present trend.

The ministry of mines, more than a year ago, talked in terms of a 4% annual growth as more satisfactory than trying to increase Venezuela's share of the world's oil market. If the first 6 months of 1960 is any criteria, Venezuela doesn't need to worry about growing too fast.

During the first half of last year, production averaged 2,852,800 bbl. daily. The first half of 1960 the daily average was 2,849,400, a far cry from a 4% increase.

Last year government income from all taxes and royalties paid by the oil industry was Bs. 3,004,000,000 (about $901 million). When the budget for 1960-61 was presented to congress in Caracas recently, the finance ministry said it expects income from all sources of Bs. 5,500,000,000 (about $1,680,000,000). This estimate, the finance ministry told Congress, was based on reduced oil income because of lower prices and higher labor costs, but still anticipated a 4% increase in output.

If the government's oil income reaches the level necessary to support this budget, output is going to have to jump at least 8% and all the production will have to be sold at posted prices. This is not likely under today's market conditions.

If the first year of the government's ambitious 4-year program gets off to such a poor start, the other 3 years are going to have to show a marked reversal of today's trend in the Venezuelan oil industry for the new plan to work.

Central Bank report . . . At about the same time that the new 4-year plan was being unveiled, Banco Central de Venezuela in Caracas issued its annual report which contained some interesting oil industry figures bearing on reduced profits and restricted government income.

Last year 43,056 workers were employed in the oil industry, a decrease of 1,421 from the previous year, or a drop of 3.2%. Most of this drop came because of a sharp decrease in exploration activities. Refining employment remained fairly stable during the year.

The median annual income of the Venezuelan oil workers in 1959 went up to Bs. 23,200 ($6,960), compared to an average of Bs. 22,700 ($6,810) the previous year.

Europe's Octanes Going Up

OCTANES are climbing rapidly in Europe for both regular and premium gasolines.

A survey of 13 countries by Associated Ethyl Co., Ltd., London, shows RON ratings of 100-octane or better are found increasingly often. Octane numbers in the 70's for regular are almost a thing of the past.

The premium count in many countries compares favorably with the United States, where typical premium is now about 100 octane. Typical regular grade in the U. S. is about 93 octane.

One-hundred or 101-octane is now sold in some outlets in West Germany, Switzerland, Italy, and United Kingdom. Last year it was available only in Italy and U. K.

Norwegian dealers have the only regular in Europe with ratings as low as 79.

Research Octanes in Europe

Country	Regular 1960 Spread	Regular 1959 Spread	Premium 1960 Spread	Premium 1959 Spread
West Germany	88-92	86-89	97-101	95-98
Switzerland	87-91	85-89	94-100	94-99
Sweden	88-90	83-85	96-98	93-94
Finland	87-88	79-87	94-95	94-95
Belgium	85-88	84-88	94-97	93-97
Austria	82-87	81-87	93-97	92-94
Italy	84-86	84-86	98-100	98-100
Netherlands	84-86	83-85	93-95	90-94
Denmark	83-86	82-86	95-97	91-94
U. K.	82-86	80-85	95-101	95-101
France	82-85	80-83	92-94	90-94
Norway	79-84	79-83	93-95	92-94
Spain	82-83	77-79	93	90-92

New Yen-Crude Stirs Japanese Refining Plans

JAPANESE OIL in the Persian Gulf may be a springboard for a new refining and marketing venture by three of Japan's most powerful financial groups.

Prewar business giants, Mitsui, Mitsubishi, and Sumitomo are eyeing Arabian Oil Co. crude from the Neutral Zone as a supply for a proposed new refining and marketing company. The three were disbanded during the American occupation, but are rapidly regaining their former position.

Arabian Oil, in one way or another, plans to have its own refining facilities in Japan to insure a market for its crude. The most probable sites for the plants are in Osaka, Shizuoka, and Chiba. A joint company with Mitsui, Mitsubishi, and Sumitomo through the Zaizatsu group is one of the alternatives.

The Tokyo-based company plans to bring in more than 60,000 bbl. daily next year, with deliveries to start in January. A posted price for the oil will be set in September after negotiations with Saudi Arabia and Kuwait. The price is expected to be pegged closely to the posting for Safaniya crude, which the Japanese oil resembles.

The company has come up with a whale of an argument in an application to the Japanese Government asking exemption from the 6% import duty. Its lawyers contend the crude is produced from international waters and the term "foreign goods" may not be applied.

Fourth producer . . . Arabian oil has made it four for four in its drilling program.

The latest well tests 6,000 bbl. daily through a ⅞-in choke from the Burgan sand at 5,250 ft. putting it in the same class as the first three tests. It is a mile southwest of the discovery, which is 25 miles off the Neutral Zone.

The company may shift to Japanese drilling crews next year when its contract with International Drilling Co. expires. Talks on the shift are in progress with Teikoku Oil.

Crude production will be stored in five stationary tankers moored at the field. A new firm, Arabian Oil Enterprise Co., will be set up by Arabian Oil and Nitto Shosen (Shipping) to operate the station.

All-Japanese company . . . Mitsui and Mitsubishi already are in the oil business in conjunction with American companies.

Mitsui controls General Bussan and General Oil, which are tied to Standard-Vacuum through Toa Nenryo Oil Co., held 55% by Stanvac. The Mitsubishi group has 51% interest in Mitsubishi Oil, with Tidewater holding the remaining 49%.

Toa Nenryo last year handled 19.1% of product sales in the country and Mitsubishi 9.6% (OGJ, July 25, p. 141).

But the three groups now are considering an all-Japanese refining and marketing firm completely free from foreign capital, influence, or supply sources. They also are seeking a way out of the declining coal business.

Land is already being sought for terminal and refinery sites. Sumitomo has applied to Osaka prefecture for a lease on land being reclaimed at Sakai. Mitsui is looking for land at Goi in Chiba prefecture.

FOREIGN BRIEFS . . .

Russia has promised to ship four European satellites more than 60 million metric tons, or about 440 million barrels, of crude and products by the end of 1965. East Germany will take over 17 million tons, or 125 million barrels; Hungary, 6.6 million tons, or 48 million barrels; and Czechoslovakia, 22 million tons, or 160 million barrels, of crude. Poland will receive 8.5 million tons, or 62 million barrels of crude, and 7.7 million tons, or 57 million barrels of products.

Big-inch enameled pipe for use in gas transmission lines will be produced by Russia. First field trial with the pipe will be made in a 20-in. and 28-in. system being laid in eastern Ukraine.

A new target of 12.2 million metric tons, or about 244,000 bbl. daily, for Romanian crude output in 1965 is less than the original goal for this year. If reached, it will be up only 7% from last year's output of 229,000 bbl. daily.

Argentina has doubled the number of wells to be drilled and completed under a contract with a subsidiary of Italy's ENI. The revised agreement with Saipem increases the number of wells in the program from 300 to 600. The work will be carried out on the southern flank of Comodoro Rivadavia field.

British Hydrocarbon Chemicals, Ltd., has placed its third ethylene plant at Grangemouth, Scotland, on stream ahead of schedule. The company is owned jointly by British Petroleum and Distillers Co.

Libya Shell's second stepout to its Bir Tlacsin discovery in Block 70 has revived hopes in the area. The A3 tested 600 bbl. daily of 43°-gravity crude on an 18-hour test from 7,740 ft., about 100 ft. higher than in the discovery. But pay is a 2-ft. interval, and the company doesn't yet consider the well a producer. The A2 stepout was abandoned as a dry hole.

Polybutene for the European Common Market area will be manufactured by Naphthachimie under a license covering the Cosden Petroleum Corp. process. A unit will be built at the company's petrochemical complex at Lavara, France.

A stabilization plant on the CFP(A) side of Hassi Messaoud oil field is being expanded from 54,000 bbl. to 100,000 bbl. daily by Stone & Webster.

Sun Oil's SVS-41 in Block 1 of Lake Maracaibo has found the thickest net oil sands of any well in Venezuela, with a total pay of 1,558 ft. The ministry of mines calls the well one of the most important of the year. The pay includes the Santa Barbara sand and the B group of Eocene.

Esso Standard is considering 10,000-bbl. capacity for its planned refinery at Acajutla, El Salvador. Shell also has plans for a 10,000-bbl. plant in the Central American country.

A Pakistan refinery at Karachi will be constructed by Kellogg International. The 30,000-bbl. refinery is expected to be completed within 2 years. Caltex, Stanvac, Shell, and Burmah Oil will hold 60% interest. Pakistani sources will supply the rest of the capital.

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His local knowledge is vital. It helps keep him—and you—out of unforeseen situations. It helps him sense trouble before it starts. It guides him—and you—when you get into something you couldn't anticipate.

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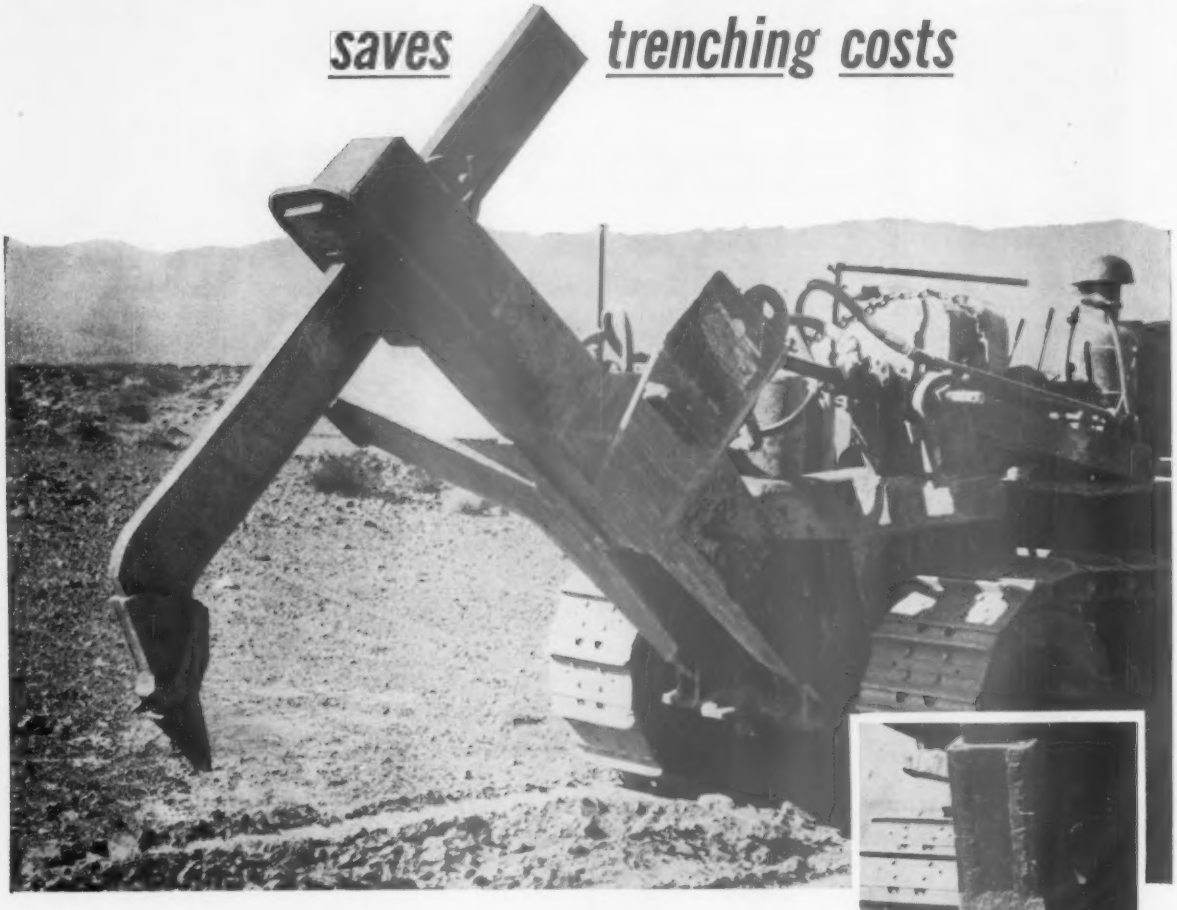

Upper photo shows method of hard-facing back side of point and adapter. Lower photo illustrates front faces and sides.

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Crossing the heart of one of California's deserts is an 86 mile stretch of 34" gas line. This area was once riddled with lava flows and eventually overlaid with hard-packed sand. Large ditchers were stopped by the lava beds; explosives could not be economically used until location of each lava flow was determined.

To overcome these difficulties, the contractor designed and built a giant single-tooth ripper. Pulled by a D7 Tractor along the pipe line route at a depth of 5 feet, subsurface conditions were quickly determined. Areas free of lava were then trenched with conventional equipment. Where lava flows were discovered by the ripper, wagon drills prepared the beds for explosives.

The ripper used easily replaceable boot-type points and adapters of mild steel plate. On this job they lasted just two hours. The boots and adapters were subsequently manually hard-faced with cross beads of Coated Tube Stoodite—*stayed in service thereafter for 3 full 8-hour days!*

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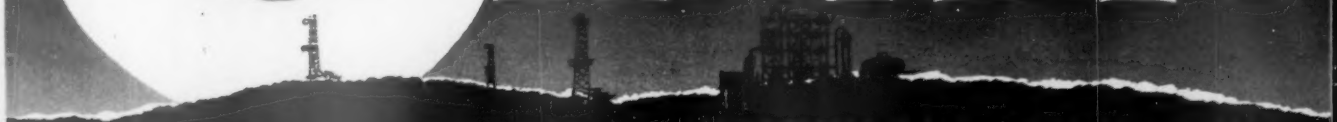


. . . poised for the payout

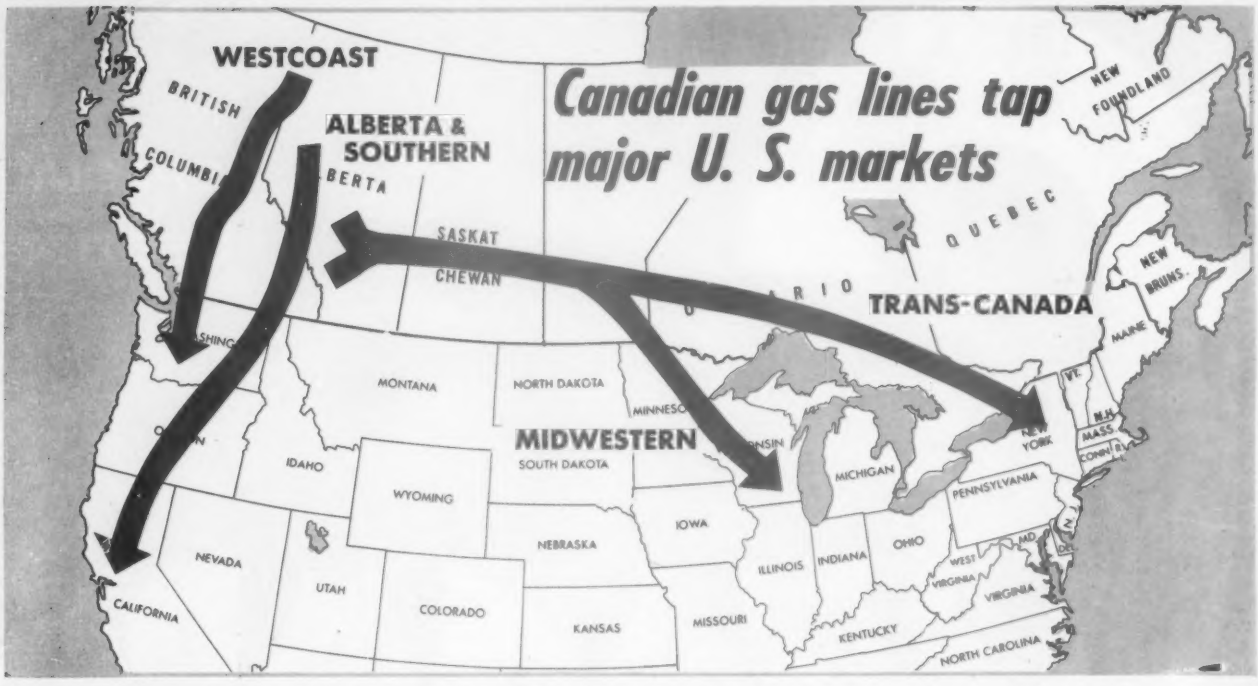
IN A LITTLE MORE than a decade, Canada's oil reserves have grown from 100 million barrels to 4 billion. Gas reserves are up from less than 4 trillion cubic feet to 30 trillion . . . all this despite the production of more than a billion barrels of oil and 4 trillion cubic feet of gas in the interim.

Production of oil has zoomed from 20,000 bbl. daily in 1947 to 550,000 bbl. today—and that's less than half the nation's capacity to produce.

Canada's refining capacity has tripled since 1947, the magic year of discovery there. More than 10,500 miles of trunk pipelines have been built, and today more than 120,000 Canadians are directly employed by the oil and gas industry.

Recent developments will thrust Canada ever more to the forefront of world oil affairs. The impending export of natural gas to United States markets will trigger an enormous program of expansion as pipelines and processing plants thread their way across the country. Pressures for a bigger share of the Canadian market for western producers will inevitably bring higher production rates for oil. Discoveries of oil and gas in the Arctic regions, the Northwest Territories, and the Yukon will rip away a curtain of ice and muskeg to reveal new theaters of operations for the future that will dwarf anything now known.

And Canada will claim for itself a dominant position in the world oil picture. What has gone before is only a preface. The full story of Canadian oil has yet to be told.



HERE'S AN INDICATION of the scale of undertakings to provide for increased flow of gas from Canada to the United States by currently constructed facilities and by future pipeline projects.

As exports nurtured Canada's oil development, new pipelines will carry . . .

Gas exports to spur future Canadian growth

BY GENE T. KINNEY
East Coast Editor

CANADA is at last in a position to cash in on its wealth of natural-gas reserves and on the millions it has spent to develop them.

The optimism of operators who have drilled wells when no immediate market was in sight has been justified not only by growth of natural-gas markets in Canada itself. It has been justified by the opening of export to the United States on a scale that may be even more significant to the gas industry than U. S. markets have been for the oil industry.

Canada now has the incentive to continue its active exploration program which has permitted the dedication of more than 8 trillion cubic feet for export. And this is only a beginning.

For the vast supplies of British Columbia and Alberta will now be linked to the continent's greatest markets—California, the Pacific Northwest, the Great Lakes region, and New York. (See map.) Gas will now cease to be an economic burden and start carrying its own share of the load.

Besides heading the gas industry toward a paying basis, export projects of Trans-Canada Pipe Lines, Ltd.; Alberta & Southern Gas Co., Ltd.; Westcoast Transmission Co., Ltd.; and Canadian-Montana Pipe Line Co. will result in investment of $1 billion in pipeline, processing, and related facilities.

The economic importance of export can readily be seen from Table 1, detailing estimated petroleum-industry expenditures and income, prepared by the Canadian Petroleum Association. Estimates were made without gas export and with gas export to support the case for U. S. sales before the National Energy Board.

The figures show that operators have clearly been investing for the future. During 1947-58, the annual exploration and production outlay increased from $25.4 million to $567.2 million. (This is exclusive of the $1.1 billion in oil and gas transportation, $820 million in refining, and $400 million in petrochemical facilities for the 12-year period.)

Annual revenue, meanwhile, increased from $21.2 million in 1947 to $421.6 million in 1958. While $3.9 billion was spent on exploration, development, and production of oil and gas, only $2.2 billion (after royalty) has been recovered.

Table 1—Estimated Petroleum Industry Expenditures and Income in Western Canada 1959-68

(Thousands of dollars)

WITHOUT GAS EXPORT

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	Cum. 1959 through 1968
Outlay:											
Exploration costs	250,000	310,000	320,000	330,000	340,000	350,000	360,000	370,000	380,000	392,000	3,402,000
Development costs	155,000	162,800	159,200	156,800	153,200	152,600	157,400	153,200	152,000	153,800	1,556,000
Gas utilization	21,000	23,500	17,400	12,400	12,100	17,200	12,500	11,600	12,900	12,000	152,600
Production expense	89,800	103,300	115,600	130,100	139,500	148,200	157,900	167,500	176,200	186,000	1,414,100
Total outlay	515,800	559,600	612,200	629,300	644,800	668,000	687,800	702,300	721,100	743,800	6,524,700
Income:											
Value of production:											
Crude oil	416,000	465,500	515,000	580,000	620,000	658,000	695,000	738,000	775,000	815,000	6,277,500
Natural gas	67,600	88,500	103,700	117,300	127,500	137,500	151,400	161,900	173,000	183,600	1,312,100
Subtotal	483,600	554,100	618,700	697,300	747,500	795,500	846,400	899,900	948,000	998,600	7,589,600
Less royalty payments	55,400	62,600	69,600	78,400	83,900	89,000	94,600	100,200	105,500	111,200	850,400
Income after royalty	428,200	491,500	549,100	618,900	663,600	706,500	751,800	799,700	842,500	887,400	6,739,200
Net investment to be recovered	87,600	108,100	63,100	10,400	(18,800)	(38,500)	(64,000)	(97,400)	(121,400)	(143,600)	(214,500)
Cumulative net investment to be recovered	1,730,900	1,839,000	1,902,100	1,912,500	1,893,700	1,855,200	1,791,200	1,693,800	1,572,400	1,428,800	

INCLUDING GAS EXPORT

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	Cum. 1959 through 1968
Outlay:											
Exploration costs	250,000	310,000	320,000	330,000	340,000	350,000	360,000	370,000	380,000	392,000	3,402,000
Development costs	155,000	162,800	174,800	204,300	153,200	153,200	157,400	153,200	152,000	153,800	1,619,700
Gas utilization	21,000	63,500	86,500	12,400	12,100	17,200	12,500	11,600	12,900	12,000	261,700
Production expense	89,800	103,300	120,100	147,800	157,000	165,700	175,600	185,000	193,900	203,500	1,541,700
Total outlay	515,800	639,600	701,400	694,500	662,300	686,100	705,500	719,800	738,800	761,300	6,825,100
Income:											
Value of production:											
Crude oil	416,000	465,500	515,000	580,000	620,000	658,000	695,000	738,000	775,000	815,000	6,277,500
Natural gas	67,600	88,600	120,600	182,000	193,500	204,400	219,600	231,100	241,800	253,900	1,803,100
Subtotal	483,600	554,100	635,600	762,000	813,500	862,400	914,600	969,100	1,016,800	1,068,900	8,080,600
Less royalty payments	55,400	62,600	70,400	81,600	87,200	92,300	98,000	103,700	108,900	114,700	874,800
Income after royalty	428,200	491,500	565,200	680,400	726,300	770,100	816,600	865,400	907,900	954,200	7,205,800
Net investment to be recovered	87,600	148,100	136,200	14,100	(64,000)	(84,000)	(111,100)	(145,600)	(169,100)	(192,900)	(380,700)
Cumulative net investment to be recovered	1,730,900	1,879,000	2,015,200	2,029,300	1,965,300	1,881,300	1,770,200	1,624,600	1,445,500	1,262,600	

Source: Canadian Petroleum Association.

When the newly authorized export from Alberta begins this fall, the income picture will start to change. Canada approved the export of 204,000 M.c.f. daily by Trans-Canada at Emerson, Man., for the U. S. Midwest, and 204,000 M.c.f. daily of interruptible supply at Niagara Falls, N. Y.; 458,750 M.c.f. daily by Alberta & Southern for California; 152,000 M.c.f. daily by Westcoast Transmission for western U. S.; and 36,000 M.c.f. daily by Canadian-Montana for Montana.

The firm sale at Emerson will add $20 million in U. S. dollars a year to Canada's trade balance. The western exports, when they reach planned levels, will bring in $100 million a year. The income estimate in the table shows export will account for an added $500 million through 1968.

Export must figure even more prominently in the more distant future. The National Energy Board expects western Canada reserves, based on current discovery rates, to reach 92 trillion in 1989. It expects half of this amount to be surplus to Canadian needs and hence looking for a market in the United States. U. S. consumers, with their steadily increasing demand, will no doubt welcome this supplementary supply. And Canadian pipelines, with connections to the biggest U. S. markets, will be in a position to accommodate them.

Canadian Market Growth

Canadian domestic markets, meanwhile, will not exactly be standing still. Natural gas is expected to assume a role in Canada's energy picture in the next 20 years comparable to what happened in the U. S. in the past 20 years. (See Table 2.)

TABLE 2—ENERGY SOURCES IN CANADA (% OF TOTAL)

	1926	1945	1956	1980
Natural gas	2.3	3.4	7.7	25
Petroleum	11.9	24.3	54.8	45
Coal	81.8	64.3	29.3	17
Water power	3.9	8.0	8.2	11
Nuclear	...	...	...	2
	100	100	100	100

In 1955, average per capita consumption of natural gas in Canada amounted to 7,500 cu. ft. for a population of 15,698,000. In 1959, per capita consumption increased to 16,200 in the face of a population growth to 17,442,000, reflecting sales of Trans-Canada Pipe Lines in eastern Canada.

By 1980, the Royal Commission on Canada's Economic Prospects expects per capita consumption to be 75,000 cu. ft. for a population of 30,968,000.

Natural-gas sales through utilities totaled 282 billion cubic feet last year. By 1969, the Canadian Gas Association forecasts sales of 800 billion cubic feet.

Here is how CGA sees market growth during 1959-69:

- Residential—from 99 to 290 billion cubic feet.
- Commercial—from 44 to 85 billion cubic feet.
- Industrial—from 139 to 425 billion cubic feet, with the 1969 estimate being equivalent to Canada's entire natural-gas output for 1959.

Gas-industry investment to date has been $1.4 billion. By 1965, CGA estimates, another billion will have been spent, and by 1969 the industry will have invested $3.4 billion to produce and distribute natural gas.

Natural gas as a national industry in Canada is only 2 years old, dating from the completion of the Trans-Canada line from Alberta to Montreal. But the domestic market prospects, and approval of large-scale export, assure that this natural resource will soon become a major contributor to the Canadian economy.

Alberta-California Pipeline

Approval of the 1,400-mile 36-in. line from Alberta fields to the San Francisco area is comparable in importance to the construction of Trans-Canada.

The pipeline alone will require an investment originally estimated at $333 million. (See Table 3.) This estimate, made in 1958, was based on completion in 1960, and may now be too low. For the project can't be finished before the end of 1961 at the earliest.

Alberta Gas Trunk Line, the province's official gas-gathering agency, will lay 386 miles of transmission line and 241 miles of laterals in Alberta.

Alberta Natural Gas Co., a venture of Pacific Gas & Electric and Westcoast Transmission, will lay 108 miles

Table 3—Capital Cost Estimates of Alberta-California Gas Line

(Based on FPC application)

Item—	Alberta & Southern	Alberta Gas Trunk Line	Alberta Natural	Pacific Gas Transmission	Pacific Gas & Electric	Total
Land	...	$32,800	$16,200	$89,700	$46,700	$185,400
Right-of-way	...	1,291,600	250,500	2,356,000	1,310,900	5,209,000
General plant	$50,000	1,006,800	428,800	2,331,000	1,476,200	5,292,800
Transmission main	...	75,502,500	22,725,200	93,450,100	49,068,400	240,746,200
Measurement and regulation	...	745,000	734,600	417,100	445,000	2,341,700
Compressor stations	...	...	4,934,000	5,258,000	...	10,192,000
Total direct cost	$50,000	$78,578,700	$29,089,300	$103,901,900	$52,347,200	$263,967,100
Escalation	3,000	4,714,700	1,745,700	6,234,100	3,140,800	14,838,300
Direct cost with escalation	$53,000	$83,293,400	$30,835,000	$110,136,000	$55,488,000	$279,805,500
Engineering and inspection	...	5,817,900	1,542,000	5,507,000	1,665,000	14,531,900
Contingencies	3,000	4,164,700	1,542,000	5,507,000	2,774,000	13,990,700
Ad valorem tax capitalized	...	...	...	330,000	222,000	552,000
Interest during construction	...	3,514,400	2,017,000	6,438,000	3,451,000	15,422,400
Exchange factor	2,000	2,903,600	1,078,000	...	...	3,983,600
Total tangible plant	$58,000	$99,694,000	$37,014,000	$127,918,000	$63,600,000	$328,284,000
Intangible plant	1,700,000	...	350,000	800,000	...	2,850,000
Total less working capital	$1,758,000	$99,694,000	$37,364,000	$128,718,000	$63,600,000	$331,134,000
Working capital	80,000	500,000	300,000	870,000	330,000	2,080,000
Total cost	$1,838,000	$100,194,000	$37,664,000	$129,588,000	$63,930,000	$333,214,000

of transmission line in British Columbia. The company will also install a 14,000-hp. compressor station consisting of four 3,500-hp. engine-driven reciprocating units costing $4,934,000.

Pacific Gas Transmission, a PG&E subsidiary, will lay 614 miles of transmission line from the Canadian border to the California border and build three electric-driven centrifugal compressor stations. One station in Idaho will have a single 7,500-hp. unit costing $1,450,000. The others will have two 5,000-hp. units, with one station in Washington costing $1,924,000 and one in Oregon costing $1,884,000.

PG&E, promoter of the project, will lay the final 296 miles in California.

Alberta & Southern, a PG&E subsidiary, functions as gas purchaser. Contracts with producers call for field prices of 13.5 cents an M.c.f. through June 30, 1961; 14.5 cents for the next year; 15.25 cents for the third year; and 15.75 cents for the fourth year. The price increases 0.25 cent a year through 1973. It increases 1.25 cents each 5 years thereafter until it reaches 21 cents an M.c.f.

Delivered price at San Francisco is estimated at 42.16 cents an M.c.f. the first 5 years, based on an annual volume of 151,143,000 M.c.f.

The system was designed initially to deliver 414,000 M.c.f. daily to PG&E at San Francisco, 152,000 M.c.f. daily to El Paso Natural Gas Co. at Spokane for Westcoast Transmission, and 30,000 M.c.f. daily to Canadian Montana at the Albert-Montana border. The design provides for 16 compressor stations which will boost capacity to around 700,000 M.c.f. daily when the line is fully powered. So further export is anticipated beyond original permits.

The line will traverse rugged (and expensive) pipe-laying country, as is reflected in installation-cost estimates in Table 4. The mountainous British Columbia section will have more than double the laying cost over good terrain.

Trans-Canada Growth

Trans-Canada's 2,290-mile line was completed in 1958 at a cost of $358.5 million, and $13.5 million was spent on compressor expansion last year. This year's outlay of $39.9 million, including about $22 million for export at Emerson, will boost investment to $411.5 million. Approximately $142 million more will be spent during 1961 and 1962.

Construction of a 50-mile 30-in. takeoff from the line at Winnipeg to connect with Midwestern Gas Transmission Co. on the U. S. border, near Emerson, and eight new compressor stations will provide capacity for U. S. deliveries. System horsepower will total 148,585 hp. this fall. Six of the eight stations will be powered by gas-turbine-driven centrifugal compressors which will be remotely controlled from Toronto. Cost of the turbine units is estimated at $290 per horsepower compared with $430 per horsepower for the gas-engine reciprocating compressors.

Capacity this fall will be 701,600 M.c.f. daily out of Burstall, Sask., the originating station, and 430,600 M.c.f. daily east of Winnipeg. The 1961-62 expansions will raise capacity out of Burstall to 957,400 M.c.f. daily, and east of Winnipeg to 646,300 M.c.f. daily.

Trans-Canada expects its sales to more than double by 1962, increasing from 115 billion cubic feet this year to 250 billion in 1962. The 1964 forecast, based on increased sales to the United States, is for 345 billion cubic feet. By then Trans-Canada expects to contract for an added 204,000 M.c.f. daily for export at Emerson, and also should be delivering that volume of interruptible gas at Niagara Falls to Tennessee Gas Transmission Co.

Trans-Canada's financial statement expresses eloquently the significance of exports. The company recorded a loss of $8,410,511 on revenues of $29,626,580 in 1959, its first full year of operation. Sales at Emerson will put the company in the black earlier than would be possible otherwise during the load-building period. Forecasts are for net income of $4.5 million on sales of $86 million for the year ending October 31, 1961, and for net income to $8.3 million on sales of $120 million for the year ending October 31, 1963.

Westcoast Transmission Growth

Westcoast Transmission completed its 688-mile, 30-in. from the Peace River area of British Columbia and Alberta to Washington in 1957, and is already talking of looping the $153-million system. Westcoast serves customers in British Columbia and delivers to El Paso Natural at the Washington border.

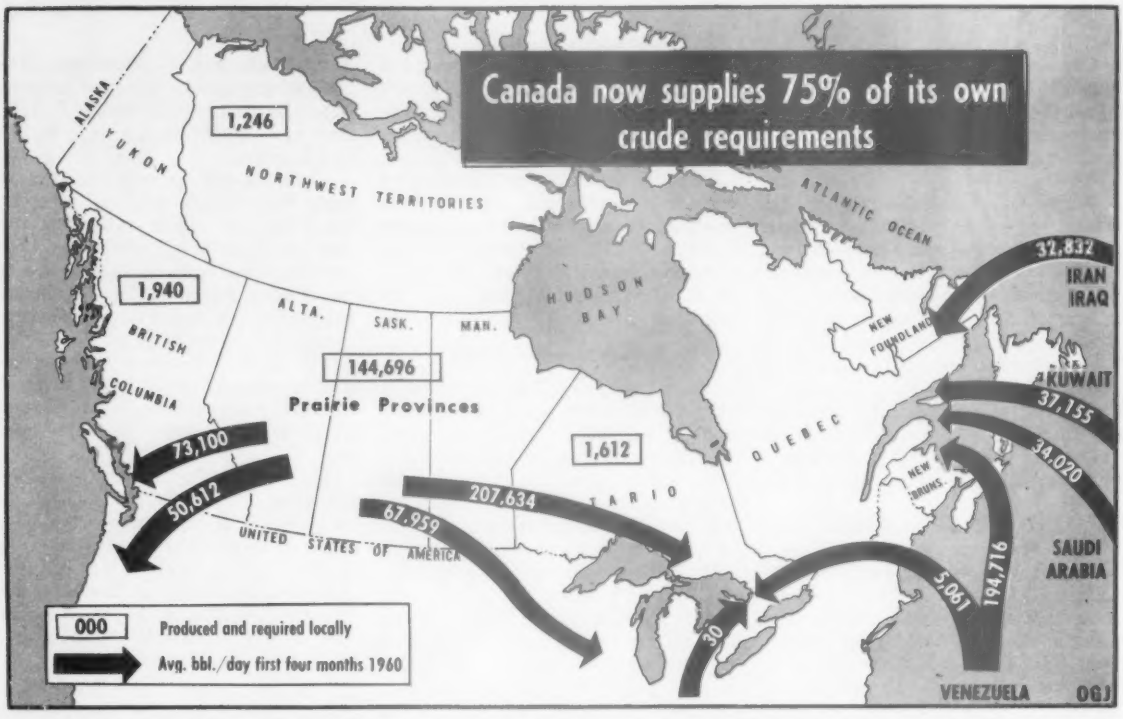
Sales averaged 244,000 M.c.f. daily last year, when the company lost $915,794. Sales estimated at more than 300,000 M.c.f. daily this year are expected to turn the first operating profit. Capacity is 450,000 M.c.f. daily, which can be increased to 650,000 M.c.f. daily by installing more stations. This figure will be doubled by the second 30-in. line.

Most of the supply for the new line will come from the Far North strikes around Fort Nelson, B. C., the origin of a 250-mile 30-in. line which will connect with Westcoast at Peace River. This pipeline, and related gas-well development, will require a $100-million investment. It has been announced for completion in the fall of 1961.

Westcoast expects to supply an increasing proportion of the gas requirements for El Paso. The outlook for Westcoast — and the other export lines—points up the growing importance of Canadian reserves to the United States, and of the U. S. market for growth of the Canadian industry.

TABLE 4—INSTALLATION COST ESTIMATE OF ALBERTA-CALIFORNIA GAS LINE
(Based on FPC application)

Diam. (in.)	Unit	Quantity	Unit cost	Total
Alberta Gas Trunk Line—Laterals				
18	foot	121,440	$3.45	$419,000
16	foot	612,480	3.09	1,892,600
12	foot	73,920	1.65	122,100
10	foot	369,600	2.79	1,030,400
8	foot	95,040	1.46	138,300
Alberta Gas Trunk Line—Main Line				
36	foot	1,351,680	$8.59	$11,611,100
30	foot	396,000	11.54	4,568,900
26	foot	290,400	10.22	2,966,800
Alberta Natural Gas Co.—Main Line				
36	foot	570,240	$13.89	$7,920,600
Pacific Gas Transmission Co.—Main Line				
36	foot	3,241,920	$9.49	$30,765,800
Pacific Gas & Electric Co.—Main Line				
36	foot	1,562,880	$10.89	$17,019,800



CANADA BECOMES MORE SELF-SUFFICIENT by swapping U. S. exports for some eastern exports. Results: Domestic crude output to Canadian and U. S. refineries now equals 75% of total requirements from Prairie Provinces and foreign sources.

Canadian refiners are marking time

▶ Excess capacity forces a near holiday in plant construction

BY D. H. STORMONT
Refining Editor

CANADIAN REFINERS, after more than a decade of steady expansion, this year are taking a break in new plant construction.

The lull applies primarily to new crude capacity. However, addition of downstream units also is off from the pace of recent years.

Reason for the construction holiday is quite simple: Existing plants have more than sufficient capacity to supply current demand, both quantity and qualitywise.

For 1960, refinery runs are expected to average about 775,000 bbl. daily, up some 40,000 bbl. from the 1959 average. This is based on a 4.9% increase in total demand during the first quarter. Gasoline demand during this period was up 6%.

Should the increased demand hold good for the entire year, Canadian refiners should still have an excess capacity of about 150,000 bbl. per day by the end of this year. This represents nearly 20% over current requirements. At the first of the year total Dominion capacity was 844,000 bbl. per calendar day. By the end of this year it will approximate 925,000 bbl. daily.

Supply picture. Just as is the U. S. oil industry, the Canadian oil industry is faced with surplus supplies of crude, despite an annual demand increase of about 10% during recent years—from 559,000 bbl. in 1954 to 814,000 bbl. daily last year—supplies of Canadian crudes have built up at an even faster rate. At the first of the year, crude and natural-gas-liquid reserves totaled more than 4 billion barrels. This compares to a total of about 2 billion barrels at the end of 1954.

Domestic production during this period rose from 267,000 bbl. daily (including natural-gas liquids) to 522,000 bbl. last year. Or Canadian output last year supplied 70% of Canada's needs, as compared with 57% in 1954. All demand could be supplied from western Canada fields but refiners in Montreal and the eastern provinces find it more profitable to use foreign crude.

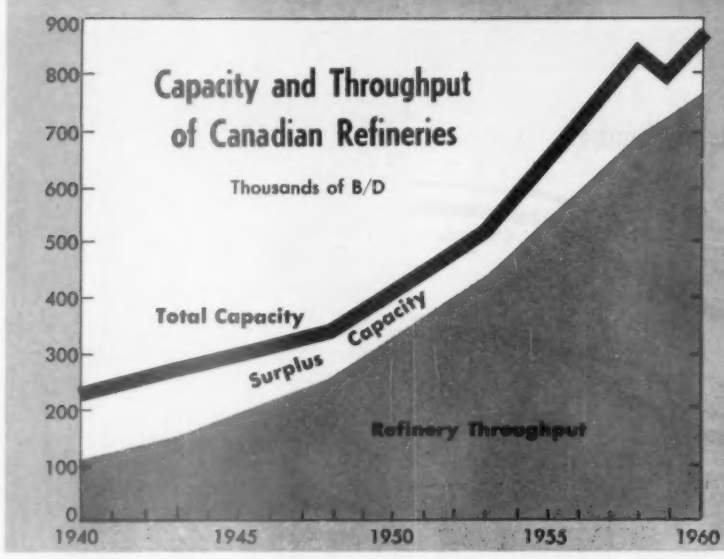
This situation is causing some western Canada independent producers to seek import restrictions. Political pressures could result in controls which would force these refiners to switch to domestic crudes, despite their higher cost. Whether this action will be taken later this year, or next, is doubtful but it is possible.

Compared with Venezuelan and Middle East crudes, Redwater crude has a disadvantage of some 23 to 40 cents per barrel laid down at Montreal. This is based on prevailing tanker rates and a pipeline tariff of 60 cents per barrel. The latter is the existing tariff from Edmonton to Toronto.

According to Vernon Taylor, Imperial Oil Ltd. vice president, Canadian petroleum production will increase to about 600,000 bbl. daily by the end of this year. Within the next 10 years it should reach approximately 1,250,000 bbl. daily, he estimates.

This production increase would be that needed to meet anticipated gains in Canadian demand and the export to logical and economic U. S. markets. Any attempt to speed up demand by the import-restriction route will not really solve Canada's long-term marketing problem, Taylor believes.

An an example of how any quota or restriction on imports could affect exports of Canadian crude to the U. S., Taylor cites a situation involving Imperial. Some 25,000 bbl. of Canadian



This year may mark the last abrupt capacity rise for a while. Canadian refiners now have an excess capacity amounting to 150,000 bbl. per day, about 20% over current requirements. Most of the unused capacity is centralized in the East.

crude now is going daily to Puget Sound refineries on an exchange basis, with Imperial taking a like amount of Venezuelan crudes into Montreal. Restrictions limiting imports at Montreal would clearly have the effect of canceling the movement of Canadian crude to the West Coast.

... **Ontario refiners,** with a daily capacity of 260,000 bbl., are accounting for most of the gain which is occurring in domestic crude usage. Last year they took an average of 198,000 bbl. daily, up 33,000 bbl. from the 1958 average. By the end of this year it is expected Canadian crude will be used almost exclusively in Ontario.

For the year as a whole it has been forecast that the output of Ontario refineries will run 4½% above the 1959 average. At the indicated level of 215,000 bbl. daily, imported oil would thus account for only some 6,000 bbl. of the daily throughput.

Refinery runs in the Maritimes and in Quebec Province will probably run somewhat higher this year. This is due to the new St. John, N. B., refinery of Standard Oil Co. of California and Irving Oil Co., and that of B. P. Canada, Ltd., near Quebec. These plants added 65,000 bbl. to the region's crude capacity, but they are expected to raise the regional runs less than 25,000 bbl. daily.

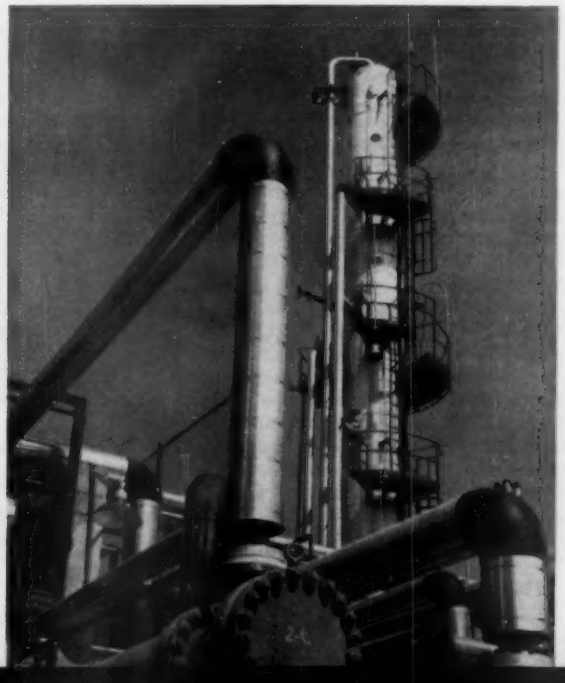
Little change is forecast in total demand in the eastern provinces this year. The new plants will supply markets formerly supplied by imported products. Product imports thus will decline substantially from the 105,000 bbl. daily 1959 average, resuming the downward trend started in 1956.

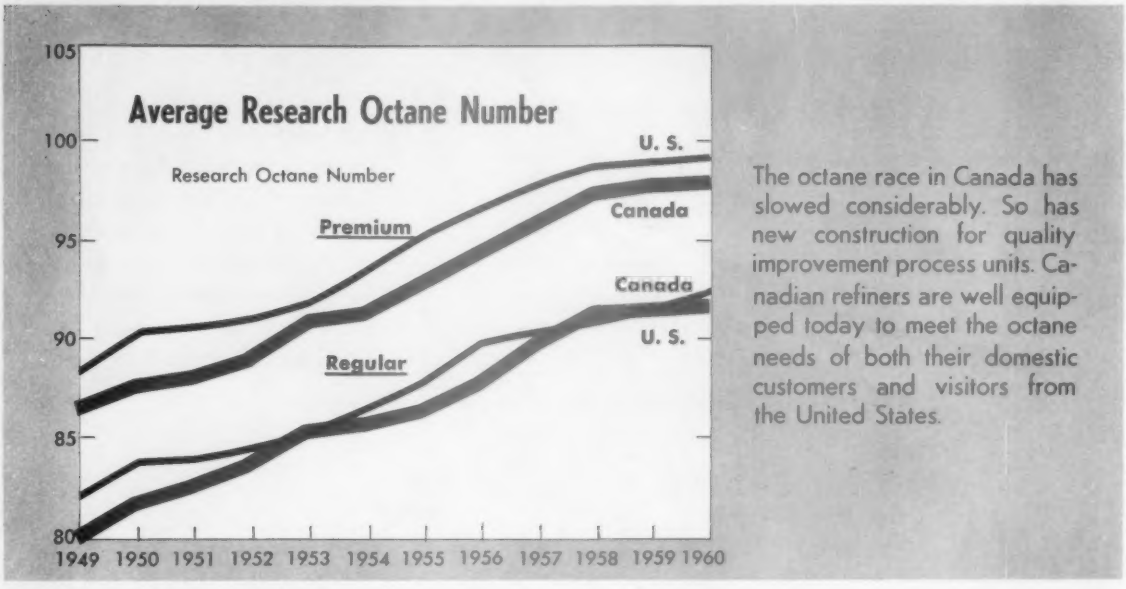
... **Crude imports** will probably swing upward again, it is now thought. Early this year the Dominion Bureau of Statistics forecast crude imports would drop 5½% to 295,000 bbl. daily. Based on first-quarter figures it now appears another increase will be shown in 1960. Some Canadian refiners estimate 1960 imports may average as much as 320,000 bbl. daily.

Middle eastern crude will continue to displace Venezuelan crude this year, barring some major change. In 1957, Venezuelan crude imports averaged 236,000 bbl. daily, compared with only 38,000 bbl. from the Near and Middle East. Last year the Middle East supplied 103,000 bbl. daily, while Venezuelan crudes dropped to 215,000 bbl.

. . . **Western province operations,** which have been somewhat at a standstill the past 2 years, probably will

ONE OF THE FEW ADDITIONS to downstream processing capacity includes British American's 8,000-bbl.-daily middle-distillate desulfurizer at Clarkson, Ont. Cat cracking capacity is also slated for an increase.





The octane race in Canada has slowed considerably. So has new construction for quality improvement process units. Canadian refiners are well equipped today to meet the octane needs of both their domestic customers and visitors from the United States.

show little change during the next year. Refining capacity will show about a 10,000-bbl. increase from the 255,000-bbl. current level, but runs are not expected to increase materially from the 216,000-bbl. average of 1959.

Most of the new construction under way there is associated with gas-condensate operations, as is discussed later. Because of the very minor demand for heavy fuel oil in these provinces, such plants fit quite well into the situation. Typical plants yield from 70 to 90% gasoline. One plant under construction is designed to yield about 50% of 90-octane (clear) gasoline.

Refinery construction. For the first time in many years, no major refineries or additions to crude capacity are under way. Interviews with officials of several large refiners point to this situation remaining unchanged for the next year, if not longer.

At midyear, only one major project was known to be on the drawing boards. This was the 20,000-bbl. plant announced by Shell Oil Co. of Canada, Ltd., for Bronte, near Toronto, Ont.

During the past year, Canadian refiners added about 90,000 bbl. (calendar days) of crude capacity. This work, plus that under way, will bring total Dominion crude capacity to about 925,000 bbl. daily by year end.

Bulk of this new capacity resulted from the construction of the Irving and BP Canada plants. The former has a 40,000 bbl. capacity and the latter is rated at 25,000 bbl. daily.

The $50,000,000 Irving refinery was completed last April. Operating primarily on Middle eastern crude, its output will include gasolines, diesel oil, light and heavy fuel oil, asphalt, and LPG.

British Petroleum's Montreal East refinery was brought on stream at about the same time. Its products are much the same as those of the Irving refinery, with particular design emphasis being placed on a high gasoline yield and middle distillates with low pour points.

...**Work under way** will add less than 10,000 bbl. to Canada's crude capacity. Most of the capacity is associated with crude units being built in conjunction with Alberta gas-condensate plants. Other work under way included new alkylation and catalytic reforming units.

One of the largest gas-condensate projects under way is that of Canadian Oil Companies, Ltd., in the Innisfail area of Alberta. When completed this fall it will have a capacity for processing 2,000 bbl. daily of crude and 4,000 bbl. of condensate. In addition to an atmospheric distillation unit, facilities include a hydroesulfurization unit and a catalytic reforming unit.

At Calgary, British American Oil Co., Ltd., is boosting crude capacity by 4,000 bbl. to 11,500 bbl. daily in order to handle the increased condensate output of its Pincher Creek gas plant. Also being added is a 3,500-bbl. hydrodesulfurization unit. Capacity of its Edmonton refinery also is being boosted by 5,000 bbl. to handle condensate from its new Dick Lake plant.

Still another project is that of Phillips Petroleum Co. and Pacific Petroleums, Ltd., at the Taylor, B. C., field processing plant. Additional crude capacity is being added, as well as a 2,000-bbl. Platformer and a 3,250-bbl. Unifiner.

Downstream processing. Canadian refiners have kept pace with U. S. refiners in all downstream processing phases except alkylation. Percentagewise they still lag in alkylation capacity but they are taking steps toward greater use of alkylates as a source of octanes.

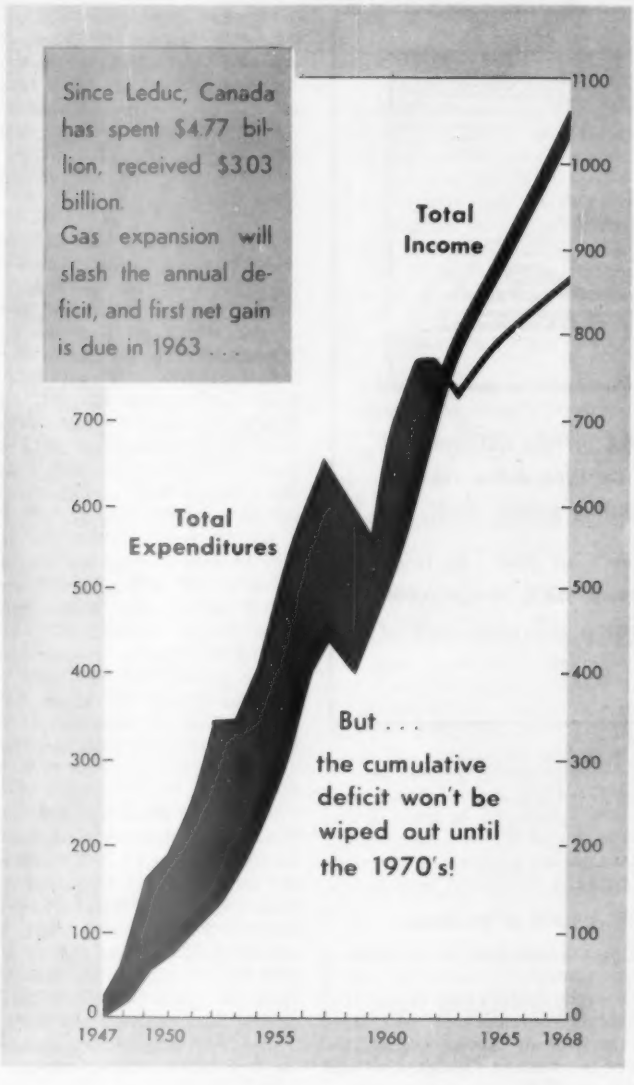
At the first of this year total alkylation capacity was 5,570 bbl. per stream day. New units being added will bring the total to 12,770 bbl. daily. Related to crude—charging capacity, Canadian alkylation capacity thus will amount to about 1%. This compares with the U. S. figure of 4%. About 5,200 bbl. of the new alkylation capacity uses the HF process.

They also lag percentagewise, but not far, in cat cracking and cat reforming capacities. They lead, however, in the percentage of the crude barrel which is hydrogen treated. New units added or to be completed this year will bring the total hydrogen-treating capacity to about 220,000 bbl. The ratio thus will be about 23% as compared with less than 20% for U. S.

Gasoline quality. Canadian refiners last year were a little more hesistant than U. S. refiners in boosting the octane number of their motor fuels. The research octane number of premium gasoline rose 0.4 to 98.7, according to Ethyl Corp. of Canada, Ltd. That of regular gasoline gained only 0.1 to 92.3. These year-end figures compared with the U. S. averages of 99.3 and 92.4, respectively.

Canadian refiners are continuing to approach the U. S. level in the research octane number of their premium motor fuels. Five years ago the average Canadian premium fuel trailed by about 3 research numbers: Now the spread has been cut to about 0.6.

Average research octane number of their regular gasolines, however, did not keep pace with the U. S. trend last year. The 0.9 gain in research octane number of the U. S. regular brought the average above Canada's.



GAS will put Canadian operations in the BLACK

. . . in 3 years

"Net gains should then progressively increase"

BY CARL O. NICKLE
Calgary, Alta.

WESTERN CANADA'S oil and gas industry, in mid-July 1960, is producing petroleum at one-half of capacity, and natural gas at one-quarter of capacity. The short-term outlook for oil production is obscured by a number of uncertainties, while the near-term outlook for gas is highly favorable. The long-term outlook for both oil and gas is regarded at favorable—despite present uncertainties—and value of production is expected to double to over 1 billion dollars yearly by 1967.

Last April, after years of debate, Canada's growing surplus of natural gas cleared its final obstacles in the dominion, when the new National Energy Board approved export projects that will permit nearly 1 billion cubic feet daily to move into United States markets.

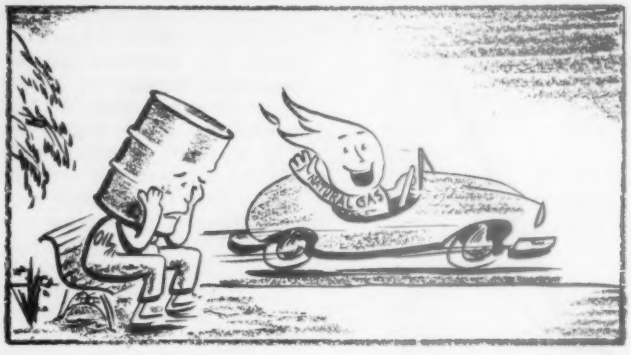
What's Ahead

Provided the American authorities complete approvals in time, a ¾-billion-dollar crash program of pipeline construction, field gathering, and gas-processing-plant construction will be rolling next month. By November 1961 the number of border-crossing points for Canadian gas will rise from the present two to seven, and in 1962 Canada's gas will be supplementing American supplies in U. S. markets to the tune of over 400 billion cubic feet yearly, for a border value exceeding $100,000,000.

Canada's gas production faces a rapid expansion, not only for export but for domestic markets, where pipeline connections now extend for some 2,500 miles from the Pacific Coast to Quebec Province. Canada's hunger for gas is expected to increase 30% this year, to 365 billion cubic feet, and is forecast at over 660 billion cubic feet by 1965 and over 875 billion cubic feet by 1970.

Exports to the United States, which were only 85 billion cubic feet last year, will climb to over 400 billion cubic feet by 1962 with approval of and construction of pipelines to cover existing permits. But it may be reasonably assumed that, by 1962, proved reserves in western Canada will have been increased by an amount nearly equal to the authorized exports of the next 20 years.

It is now certain that the big three exporters — Westcoast Transmission, Alberta & Southern Gas, and Trans-Canada Pipelines—and others, will be requesting additional volumes of surplus Northeast British Columbia and Alberta gas for export markets. Favorable action is likely. Thus by 1965 Canada may be delivering as much as 800 billion cubic feet yearly at the American border, with a border worth of $230,000,000.



Forecast gas sales for 1960 of $88.6 million will represent 16% of industry revenue in Canada. By 1968 dollar value of gas sales will grow to over a quarter-billion dollars yearly.

But the oil-marketing situation isn't so rosy. In brief, western Canada's oil wells have a current MER of 1,100,000 bbl. daily, with current actual production just under half of capacity, or 540,000 bbl. daily.

By 1970 the forecast is 1 trillion cubic feet yearly, with border worth some $300,000,000.

No lack of gas. The availability of gas is not a problem. The National Energy Board places established gas reserves as of last January 1 at 30.3 trillion cubic feet, and forecasts an average discovery rate of 2 trillion cubic feet yearly the next 30 years, raising total disposable reserves to 92 trillion by 1989. After taking into account reserves needed to meet annual and peak-day deliveries for all Canadian markets for 30 years, the board arrived at a prospective surplus to Canadian needs of 48 trillion feet. Of that, 2.1 trillion was allocated to U. S. markets prior to 1960, and the recent NEB approvals covered 6.7 trillion of exports over 21 years, requiring 8.3 trillion cubic feet of reserve dedications.

Forecast reserve growth for 1960 by industry sources is 4 trillion cubic feet, with sizable volumes in subsequent years. Thus more exports can be authorized in 2 to 3 years, while still maintaining adequate safety margins for Canadian needs of the future.

First effect of American approval of the current export-import bids will be a 20-month half-billion-dollar capital investment in western Canada, including about $300,000,000 in some 1,000 miles of big inch transmission pipelines, $150,000,000 in gas-utilization projects in Alberta fields, and $50,000,000 in gas-exploration and development drilling. An additional quarter-billion dollars will be spent during the same period in the United States for transmission pipelines to complete links between fields and markets.

A Look at the Books

Far more important to the west—and to Canada's economy as a whole—is the longer-range impact that gas-market development will have upon the over-all expenditure and income of the western Canadian oil and gas industry. Let's examine the past—and the future—as revealed in studies made in cooperation with the Canadian Petroleum Association. In chart form, the income and outgo of the industry, past and future, accompanies this article. The forecasts may be considered conservative.

So far as the oil phase of the industry is concerned, they are based upon normal growth in the market areas now being served. So far as gas is concerned, they take into account only the expected Canadian market growth and the currently approved gas exports. Approval of additional gas-export permits over the next few years will substantially revise upwards both the expenditures and income from the gas phase of the industry.

The Canadian Petroleum Association forecasts that the industry will spend about $7.13 billion during the 9 years 1960-68, on exploration, development, production costs, royalty payments, and gas utilization, an average of $792 million per year. During the same period, gross income from oil and gas is expected to total about $7.6 billion, an average of $844 million yearly. This will mean a net gain averaging $52 million yearly, or $468 million in total.

In the red now. The forecast is in sharp contrast to the record for the 13 years since the 1947 Leduc discovery sparked the major expansion of the West's oil and gas industry. From Leduc to the end of 1959, the industry expended a total of $4.77 billion, an average of $367 million yearly, and had a gross revenue of only $3.03 billion, or $233 million yearly average. By the end of last year, the industry had accumulated a net deficit of $1.73 billion.

By the end of 1968, the industry will be able to total up an outgo of about $11.9 billion, and income of $10.6 billion, and a net deficit of some $1.26 billion. All forecasts would, of course be revised by changes in the gas and oil marketing picture. At first glance one might be pessimistic about the ultimate profitability of the western Canadian industry. Not so.

But out in 1963. Spurred by gas expansion, the industry faces the biggest income and outgo in its history, and the largest of any Canadian resource industry. It will spend more than it takes in for another 3 years, but the annual deficit will be rapidly reduced, and will be turned into the first annual net gain by 1963. Net gains should then progressively increase.

By 1967 the industry should enjoy its first billion-dollar-revenue year, with a forecast net gain of $193 million. The decade of the seventies should see income heading for 2 billion dollars annually, the elimination of the accumulated deficit, and the establishment of Canadian oil and gas as one of the nation's leading revenue, employment, and profit industries.

The Role of Gas

What part will natural gas play in this? Gas sales by producers were a small factor in the industry's economy until recently. In 1957, for example, gas sales of 15.5 million represented only 3% of industry income. By 1959, gas sales of $67.6 million represented 14% of industry income. For 1960 forecast gas sales of $88.6 million will represent 16% of industry revenue. By 1962 gas sales at field prices will total some $182 million, and will represent 24% of industry income. By 1968 dollar value of gas sales will grow to over a quarter-billion yearly,

even without further approval of export bids, and will represent a quarter or more of industry revenue.

Oil Outlook Vague

Weighing against these grounds for optimism is the current unhappy oil-marketing situation in Canada. In brief, western Canada's oil wells have a current maximum efficient rate of production of about 1,100,000 bbl. daily, with current actual production just under half of capacity, or 540,000 bbl. daily.

Canada's domestic market is currently served by imports totaling 415,000 bbl. daily, including about 310,000 bbl. daily of Venezuelan and Middle East crude oil, and 105,000 bbl. daily of U. S. and Caribbean refined products. Canada's own oil exports amount to about 115,000 bbl. daily of crude, marketed in the U. S. Puget Sound and Midwest-Great Lakes areas. Canada's "net deficit" on the petroleum account is draining nearly $400,000,000 yearly, and accounts for over one-third of the nation's continuing large trade deficit.

Unlike the United States, and a number of other nations, Canada still maintains an open door to imported petroleum, despite its ability to achieve self-sufficiency either in fact or in balance. In a world in which access to some two-thirds of markets is restricted by formal or informal government policies, and in which over two-thirds of oil reserves are subject to various pressures from government and others for bigger export outlets, it is unlikely that Canada's government can much longer blind itself to the situation.

The plan that failed. A year ago the Borden Royal Commission, established by the government to study the energy situation of Canada, recommended that the oil industry itself strive for a production rate of 700,000 bbl. daily by the end of 1960, mainly by backing imported products out of the Ontario market and by increased exports to the U. S. This plan would involve greater use of already existing pipeline and refinery facilities. The commission suggested that if the voluntary efforts of industry members were unsuccessful, the government should have the NEB review the situation and recommend action.

While some major oil marketers have cooperated fully to improve outlets both in Canada and the U. S., some sharers of the rich Canadian market for products have done less than their share, or nothing. In fact, pressure is still growing on Canadian markets from offshore (foreign) producing areas, and pressure is growing in the U. S. against the exemptions from U. S. quotas allowed to Canadian oil.

A hint of warning. The Canadian Minister of Trade and Commerce, Gordon Churchill, recently stated that his office and the NEB would commence a full study of the oil problem when the current session of Parliament concludes in August. There is a hint of warning. Faster progress must be made towards the "Borden target" level of 700,000 bbl. daily, or some form of government action is probable.

A strong group of Canadian independent producers believes the solution lies in a new pipeline, stretching about 2,500 miles from Alberta to Montreal, together with permanent import controls that would force conversion of the quarter-million-barrel daily Montreal refining complex from foreign to Canadian crude.

Gaining support — most recently from such bodies as the Calgary Chamber of Commerce—is an alternative plan. In essence, the proposal is that Canada's prime minister call in the heads of all companies (refiners, jobbers, importers, etc.) sharing the Canadian market of about 850,000 bbl. daily, and advise each that his company will be responsible for his pro rata share of growth of markets for Canadian crude, either by using it in greater degree in Canada or by finding a home for it elsewhere. The suggested voluntary plan—somewhat comparable to the policy adopted by France to speed growth of French North African production—would be allowed 60 days to swing into action.

Should it fail to achieve desired results, proponents of the plan suggest that Canada should adopt formal import quotas, along United States lines, that would give credit for export markets for Canadian crude attributable to those desiring to continue importing into Canada. Should that fail to realize satisfactory production targets—closer to 70% of Canadian oil potential in place of the current 50%—then Canada should go the final step and set a national oil policy fully under Canadian control, that would involve a pipeline to Montreal and attendant long-term import controls.

By one means or another, in cooperation with the United States and international oil companies, or through a purely national oil policy, Canada's oil industry will achieve a production level to better serve the economy of the country, and to increase the security and oil independence of the continent.

That is a reasonable conclusion to be drawn from the strengthening voice for oil action now being raised in Canada. The shaping of Canadian policy on oil in the months ahead will be determined in part by decisions of governments and companies outside of Canada, and will in turn further alter the structure of the world oil picture.

The Canadian balance sheet . . .

1947-59

Income	$3,034,400,000	— annual average	$233,400,000
Outgo	$4,765,300,000	— annual average	$366,600,000
Deficit	$1,730,900,000	— annual loss	$133,200,000

1960-68 (forecast)

Income	$7,597,000,000	— annual average	$844,100,000
Outgo	$7,128,700,000	— annual average	$792,100,000
Profit	$ 468,300,000	— annual gain	$ 52,000,000

1947-68 (review and forecast)

Income	$10,631,400,000	— annual average	$483,200,000
Outgo	$11,894,000,000	— annual average	$540,600,000
Deficit	$ 1,262,600,000	— annual loss	$ 57,400,000

Sometime in the 1970's this cumulative deficit will evaporate and the profit years will arrive.

Eastern Canada has a new exploratory target . . .

OIL IN TRENTON SYNCLINE

BY R. J. BURGESS

. . . geologist with the London division (southwestern Ontario) of Imperial Oil Ltd. Burgess holds a BS degree in geology from University of Manitoba. He joined Imperial in 1954 as a member of the research department in Calgary and was transferred to his present division where he has worked almost exclusively on the Ordovician and Cambrian prospects.

WITHIN the last 2 years an unusual type of stratigraphic trap, Trenton-Ordovician synclines, has become a major exploratory target.

To most of us in the oil business the mere words "synclinal oil pool" suggest a paradox or a freak entrapment. However the significance of these traps is now indisputable as Michigan's Scipio-Albion trend promises to become a major field. It is the purpose of this article (1) to describe the three producing synclinal fields, (2) to show that these fields are very similar to one another and form a definite type of stratigraphic trap, and (3) to offer some suggestions regarding the origin of this type of accumulation and the applicability of various exploration techniques to the search for synclines.

Other than the synclinal fields (Scipio-Albion, Dover, and Colchester), the only significant Trenton field is the prolific Lima trend (Fig. 1) which has produced roughly half a billion barrels of oil and an estimated 800 billion cubic feet of gas. This trend is a giant stratigraphic trap producing from a wedgeout of porous dolomites on the west flank of the Findlay arch. It was discovered in 1884 on the basis of seeps. The peak productive period was between 1890 and 1910 when Lima averaged 20 million barrels per year, or nearly one-third of the total oil production of the U.S.A. at that time. The Lima trend is an outstanding example of the potential of the Trenton.

The present Trenton play is enhanced immensely by the high allowables in Michigan (125 bbl. per day in Scipio-Albion), no proration whatsoever in Ontario, and by the high wellhead price for oil of approximately $3.00 per barrel.

Regional Stratigraphy

A generalized stratigraphic column for the Ordovician and Cambrian of the southern Michigan basin is shown in Fig. 3. The Trenton group over most of the Michigan basin is a sequence of brown and grey finely crystalline to bioclastic limestones with abundant shale laminae. The Trenton is capped by a 10 to 40-ft. unconformity dolomite.

The Black River group consists mainly of sublithographic to microcrystalline limestone with a chalky weathered zone in the upper 30 to 70 ft. and a sandy dolomitic shale zone in the lower few feet. In general, the Black River is much less argillaceous and fossiliferous than the Trenton.

The Trenton-Black River contact is picked at the base of a 5-15-ft. calcareous shale. The Trenton is unconformably overlain on the Findlay arch by the Utica black shale sequence, with the period of unconformity decreasing basinward. The Black River group unconformably overlies the Cambrian or the Lower Ordovician which are normally porous and permeable salt-water-bearing sandstones and dolomites.

The term "Trenton fields" as used in this discussion is not entirely correct as a minor portion of the pro-

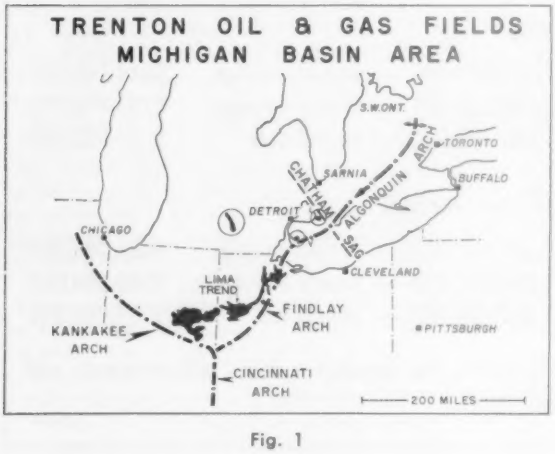


Fig. 1

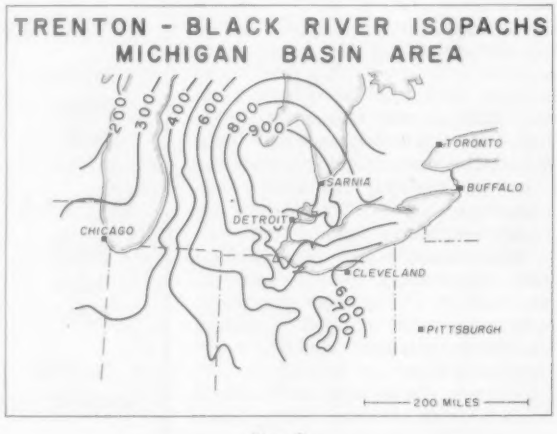


Fig. 2

GENERALIZED ORDOVICIAN AND CAMBRIAN STRATIGRAPHY
SOUTHERN MICHIGAN BASIN

SYSTEM		SERIES, GROUP, OR FORMATION	LITHOLOGY	THICKNESS (IN FEET)
ORDOVICIAN	U	CINCINNATIAN	BLACK AND GREY SHALE GRADING UPWARDS TO CARBONATE AND RED SHALES	600 - 900
	M	TRENTON	LIMESTONE-BIOCLASTIC AND DENSE 15-40' OF DOLOMITE AT THE TOP AND 5-15' OF SHALE AT THE BASE	350 - 425
		BLACK RIVER	LIMESTONE-DENSE	250 - 500
		CHAZYAN	SHALE-DOLOMITE AND SANDSTONE	0 — 30
	L	PRAIRIE Du CHIEN	DOLOMITE-SANDY AND CHERTY IN PART	0 — 350
CAMBRIAN	U	TREMPEALEAU	DOLOMITE-SANDY IN PART	0 — 400
		FRANCONIA - DRESBACH	SANDSTONE	0 — 120
		EAU CLAIRE	SANDSTONE AND DOLOMITE	0 — 300
		MOUNT SIMON	SANDSTONE	0 — 500
PRE - €				

Fig. 3

duction in Scipio-Albion, Dover, and Lima is actually from the upper Black River group. Rather than attempt to change such a simple and commonly used term as Trenton fields, the writer only wishes to point out this slight inconsistency.

The Trenton and Black River are considered as a unit in Figs. 2 and 4, which show the regional isopachs and distribution of limestone and dolomite facies. The regional dolomite and dolomite-limestone areas in the Trenton-Black River tend to rim the Michigan basin. This dolomitization probably took place soon after deposition as opposed to the later secondary dolomites in the synclinal fields where limestones have been altered along fracture zones. All significant Trenton production is from porous dolomites as the limestone sequence is essentially tight.

As a guide to future exploration for similar synclinal fields, a closer look at these three now known seems in order.

Dover

Dover field was discovered in 1917 by Union Gas Co. The discovery well came in at 6 M.M.c.f.d. from zones between 127 and 282 ft. below the top of the Trenton. Oil was encountered near the base of this interval. Subsequent drilling outlined only the most westerly pool (Fig. 5) until 1935, when the trend of the field was established. The remainder of the field was delineated between 1935 and 1940.

Structure. The field is made up of four separate pools, each situated in a local structural low on the larger syncline. The relief on the Trenton reaches a maximum of 150 ft. in the central part of the trend. Roughly 60% of this relief persists on the Lower Silurian but just a slight trace of the syncline is reflected on the Middle Devonian sediments. Thus the movements which formed the Dover syncline began during Upper Ordovician time and had essentially died out by the Middle Devonian. The Dover structure can be contoured as a fold (Fig. 5) or a fault (Fig. 6). The fold interpretation is preferred because the fracturing and dolomitization of the Trenton are concentrated in the syncline rather than along the postulated fault.

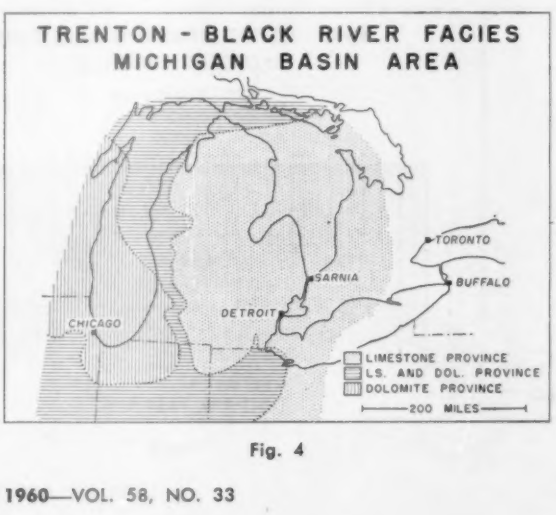


Fig. 4

Stratigraphy. All the oil and gas production is from Trenton dolomites which are confined laterally to the trough of the syncline as shown in Fig. 7. The dolomitization has emanated from four nuclei. Three out of four of these nuclei are relatively barren with the bulk of the production having been taken from the areas where the Trenton is 20 to 50% dolomite.

Certain zones in the Trenton are preferred for dolomitization; this is apparent in Fig. 8. In general, the preferred zones are relatively pure limestones with a somewhat clastic texture. These limestones were probably slightly permeable at the time of dolomitization, thus offering a path of less resistance to the dolomitizing solutions than that afforded by the dense and argillaceous limestones.

All significant porosity is confined to the dolomites. Intercrystalline, vuggy, and fracture porosity are present in varying degrees.

Oil and gas. The field produced from depths varying from 2,800 to 3,200 ft. with initial wellhead pressures ranging from 1,200 to 1,250 psi. In general, the gas pays were above the oil zones, indicating a fair degree of connection among the various dolomites. Reservoir drive is assumed to be primarily gas cap. No appreciable amount of water was produced.

At present, Dover is 4 miles long and averages 2,100 ft. in width in the productive portions. The field is now depleted after producing 12.4 billion cubic feet of gas from 38 wells. The productive area is estimated at 673 acres, giving a yield of 18,500,000 cu. ft. per acre. A total of 240,000 bbl. of oil has been produced from 288 productive acres, a yield of 825 bbl. per acre. However, some of the oil production may have been sacrificed in favor of gas production.

The total value of production at the current price of 35 cents per M.c.f. for gas and $3.00 per barrel for oil is $5,000,000 with revenue per acre

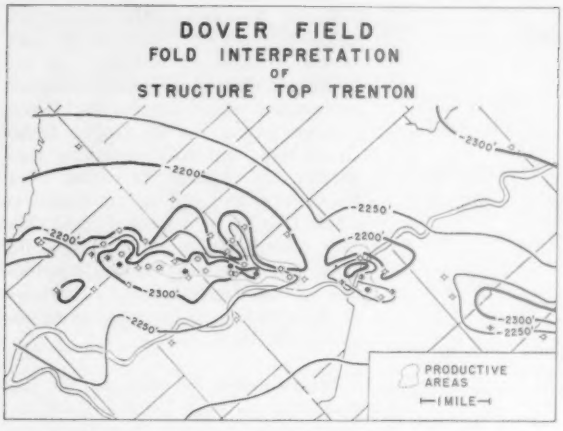


Fig. 5

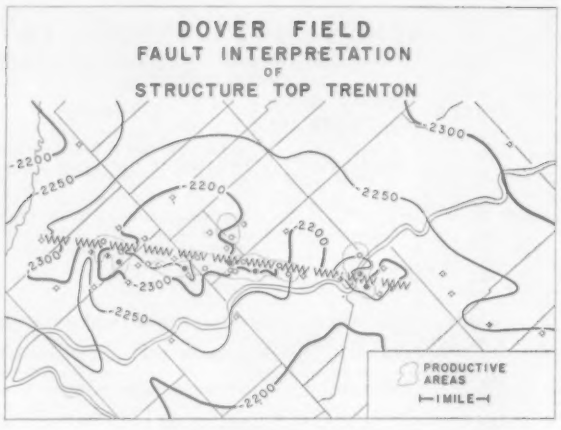


Fig. 6

being $7,500. The economics of the field are summarized in Table 1.

There is a good possibility that Dover field may be extended to the east.

TABLE 1—PRODUCTION ECONOMICS—DOVER FIELD

(A) Total value of production at present price:

12.4 billion cubic feet of gas at 35 cents per M.c.f.	=	$4,340,000
239,000 bbl. of oil at $3.00 per barrel	=	717,000
		$5,057,000

(B) Revenue per acre = $\frac{5,057,000}{678}$ = $7,459

(C) Revenue per 20 acres = $7,459 × 20 = $149,180

(D) Revenue per 40 acres = $7,459 × 40 = $298,360

Scipio-Albion

The trend was discovered by Clifford Perry, an independent, drilling in partnership with a local syndicate headed by a spirit medium. This medium had seen a vision of the landowner, Mrs. Ferne Houseknecht, with oil on her hands. The discovery well was spudded with cable tools as a Devonian test in May 1955, but when that horizon proved dry, more money was raised and the well deepened. It was not until September 1956 that gas was struck in the Trenton at 3,650 ft. and finally in January 1957 oil was struck at 3,776 ft. Increases in oil were reported to the total depth of 3,900 ft. where the well was completed at 140 bbl. per day on a plunger lift.

Structure. The trend produces from five pools situated along a linear syncline of about 30 ft. relief. The productive length of this syncline is estimated at 23 miles and the average productive width at 3,500 ft. (Fig. 9). The age of the syncline is dated between Middle Ordovician and Devonian time.

Stratigraphy. All production is confined to a "ribbon" of secondary Trenton-Black River dolomite which is situated in the trough of the syncline. Porosity is vuggy, intercrystal-line, cavernous, and fracture-type as evidenced by cores. Dolomitization and permeability are much more continuous than in Dover field, as shown on Fig. 10. Preferential dolomitization of purer limestones is present, but to a lesser degree than in Dover as shown on Fig. 11, a section through Scipio pool.

Oil and gas. As of January 1, 1960, the trend had produced 2,760,000 bbl. of oil. At that time the daily production was roughly 11,000 bbl. from 107 wells. All wells are prorated at 125 bbl. per day and/or 200 M.c.f. of gas. Development is on 20-acre spacing, both rotary and cable-tool

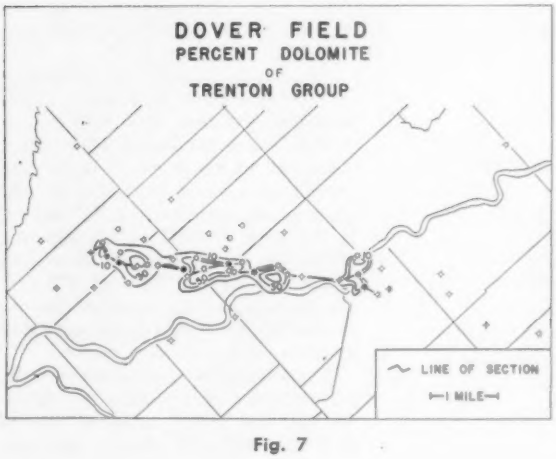


Fig. 7

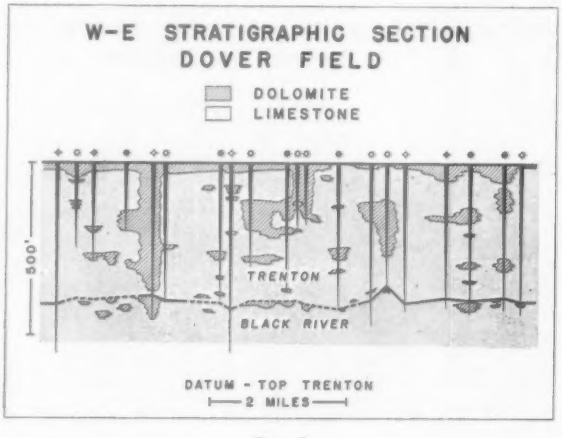


Fig. 8

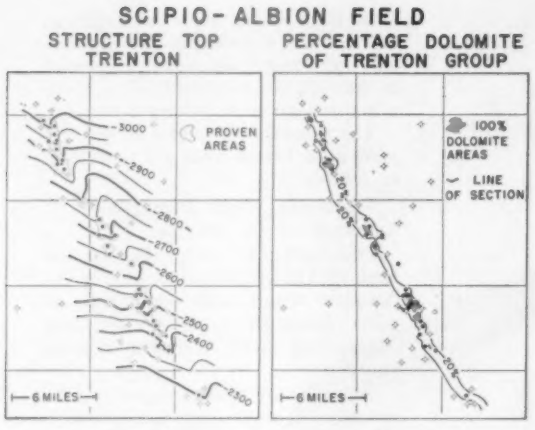


Fig. 9 Fig. 10

TABLE 2—OIL-RESERVES ESTIMATES—SCIPIO-ALBION TREND

Oil in place ..... 10,000 bbl./acre
Recoverable oil ..... 4,000 bbl./acre

PROVEN

Oil in place: 4,400 acres × 10,000 = 44,000,000 bbl.
Recoverable oil: 4,400 × 4,000 = 17,600,000 bbl.

PROBABLE

(Assuming trend to be 80% productive)
Present size: 23 miles × 3,500 ft. = 9,740 acres
Oil in place: 0.8 × 9,750 × 10,000 = 78,000,000 bbl.
Recoverable oil: 0.8 × 9,750 × 4,000 = 31,000,000 bbl.

FORECAST

(Assuming trend to be 80% productive)
Indicated size: 33 miles × 3,500 ft. = 14,075 acres
Oil in place: 0.8 × 14,075 × 10,000 = 112,000,000 bbl.
Recoverable oil: 0:8 × 14,075 × 4,000 = 45,000,000 bbl.

completions being made. Most wells are completed on a plunger lift with acidizing and fracturing commonly used with gratifying results. The crude is 39°-40° API paraffin base with a low sulfur content. Producing depths vary from 3,500 to 4,500 ft. and pressures are roughly hydrostatic along the trend.

The trend has a thick gas cap and a strong water drive which is believed to be connected to the Lower Ordovician aquifer. Each pool has definite gas-oil and oil-water contacts. The gross oil section is roughly 140 ft. in Albion, North Pulaski, and Scipio and 100 ft. in South Pulaski.

The calculated proven and possible oil reserves are shown in Table 2. The assumptions used in these calculations are:

Average porosity, %	5
Normal permeability, md.	10-20
Some fracture permeability, md.	±1,000
Connate water, %	35-40
Shrinkage factor	0.8
Average net pay (over 1 md.), ft.	45
Average gross pay, ft.	130
Recovery factor, %	40
Average productive width, ft.	3,500

The average oil in place of 10,000 bbl. per acre is considered to be reasonably conservative since a 1-md. cutoff was used for net pay. The primary recovery factor of 40% is in keeping with the large gas cap, strong water drive, 20-acre spacing, and 150-bbl. per day allowable. Preliminary pressure decline estimates also support this average recoverable of 4,000 bbl. per acre.

To date very little is known regarding the size of the gas cap. Only a very crude estimate can be made on the basis of an average of 70 ft. of net pay and a recovery of 270 M.c.f. per acre-ft. Using the acreage figures from Table 2, the gas reserves are estimated as follows:

Proven:
4,400 acres × 270 × 70 = 80 billion cubic feet
Probable:
7,800 acres × 270 × 70 = 150 billion cubic feet
Forecast:
11,200 acres × 270 × 70 = 210 billion cubic feet

It is evident that at the current price of 20 cents per M.c.f. the value of the gas combined with gas storage may equal the value of the oil.

The Scipio-Albion trend is now 23 miles long and where sufficiently outlined averages 3,500 ft. in width. Already 40% of this area has proved productive and it is probable that 70 to 90% of the trend will ultimately prove productive. The forecast or indicated length of the trend is based on two wells to the northwest which encountered anomalous dolomite sections in the gas zone. Both these wells are currently being offset.

Few dry holes have been drilled and the trend is wide open for extension to both the north and south.

Colchester

Colchester pool was discovered in April 1959 by Colchester 76-1 South, a well drilled by Imperial Oil Ltd. in partnership with Harvest Petroleums and Submarine Oil & Gas, the latter two companies each owning a 25% interest. The discovery well was based on offsetting an old test which had

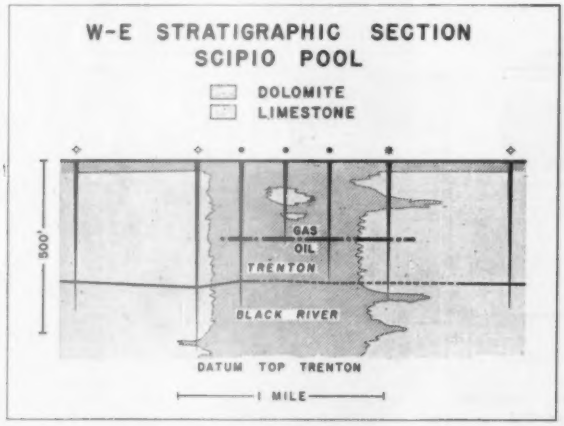


Fig. 11

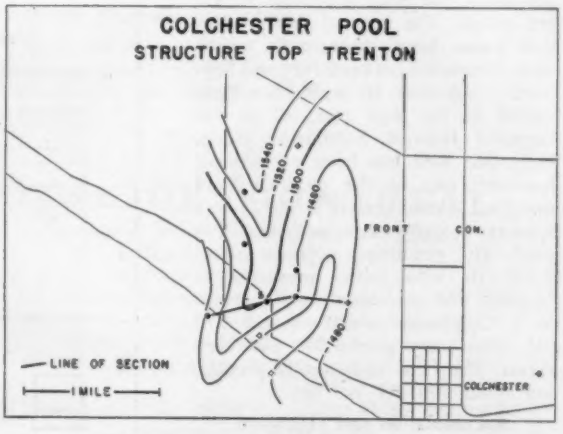


Fig. 12

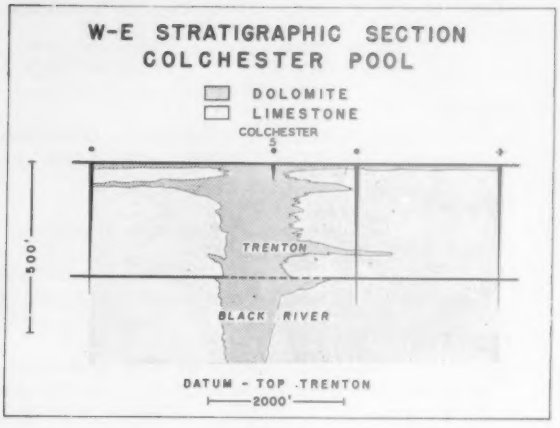


Fig. 13

encountered a show of oil 85 ft. below the top of the Trenton.

Structure. The Trenton structure contours shown in Fig. 12 represent the interpretation in December 1959 after 6 Colchester was completed. The structure is contoured as a north-south-trending syncline of roughly 40 ft. relief. The syncline is centered on the prolific 5 Colchester well.

Stratigraphy. The stratigraphy at Colchester is shown in Fig. 13, a section nearly transverse to the postulated trend of the pool. The same pattern appears to be present as in Dover and Scipio-Albion fields, i.e., the dolomite is centered in the syncline. It is unfortunate that 5 Colchester could not be deepened further, but it is assumed that most of the Middle Ordovician section encountered would have been dolomite as is the case in the "heart" of the Scipio-Albion trend. Other than 5 Colchester, all the production is obtained from a dolomitized fragmental limestone 40 to 80 ft. below the top of the Trenton.

Oil and gas. During the first 6 months of operation, July to December 1959, the pool produced 52,000 bbl. of oil. The bulk of this production came from three wells which were completed between July and September. To date 10 wells have been drilled in the pool area, all by the Imperial - Harvest - Submarine group. Only one well has been abandoned; however, two of the producers are marginal. Development is on 23-acre spacing; rotary tools are normally used. The producing depth is about 2,100 ft. with initial pressures of roughly 920 psi. in all wells except in 5 Colchester which showed 770 psi. after some production had been taken. The field is currently producing about 500 bbl. per day.

Accumulation and Migration

Source of the oil in the various Trenton fields is believed to be the Trenton itself as well as the Upper Ordovician shales. Since the suggested source rocks are roughly 500 ft. thick, only local migration would be needed to furnish the hydrocarbons in even a major field such as Scipio-Albion.

The sequence of events in the formation of Dover field are postulated as follows (Fig. 14):

Fracturing, which accompanied the formation of the syncline.

Dolomitization along the fracture zone by Cambrian and/or Lower Ordovician waters with some beds of purer limestone being preferentially dolomitized away from the fracture zone.

Migration of hydrocarbons into the porous dolomites from local sources in the Trenton limestone and Upper Ordovician black shales.

The postulated sequence of events which led to the formation of Scipio-

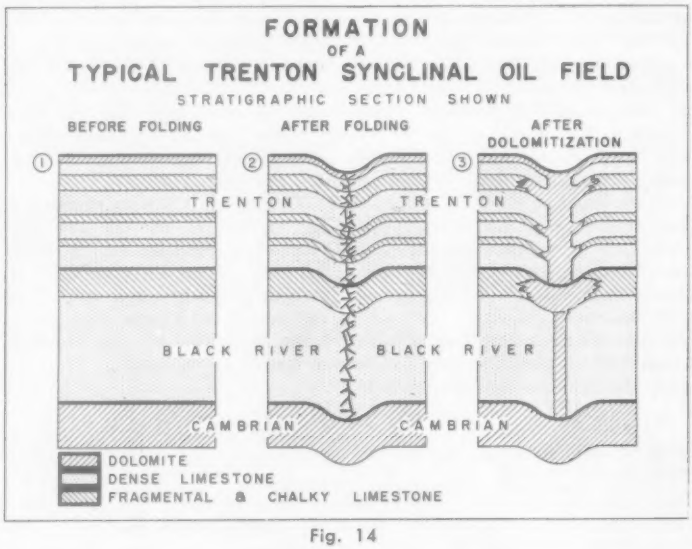


Fig. 14

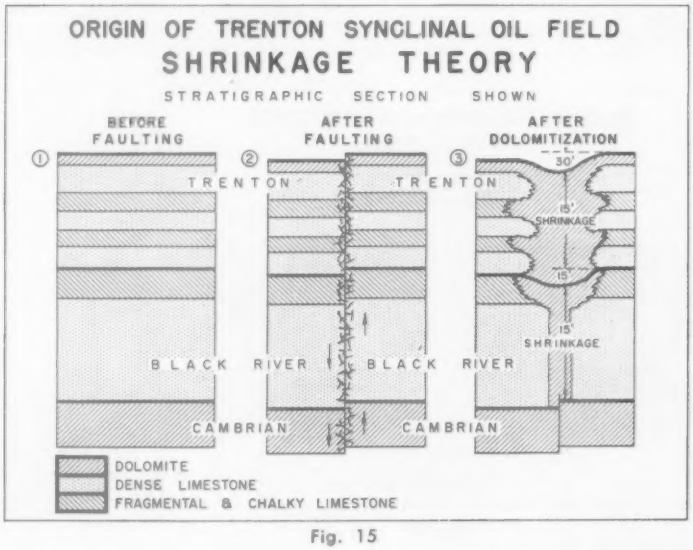


Fig. 15

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Albion and Colchester fields are similar to Dover with one very important exception—that is, the fracture system is set up by normal faulting with very minor vertical displacement. Dolomitization results in a shrinkage of the Trenton-Black River section of 30 to 35 ft., as illustrated in Fig. 15. This shrinkage superimposes a shallow syncline on the normal fault zone. Isopachs of the Trenton in Colchester and Scipio-Albion fields show conclusively that shrinkage is not merely a theory but an established fact. Porosity development and shrinkage during dolomitization are attributed to an excess of limestone solution over dolomite deposition.

Exploration Techniques

The shelf and hinge area of the Michigan basin is considered most prospective for Trenton synclines because: (1) the three known synclinal fields occur in this area, (2) this is the area where the basin has been most active structurally, and (3) the hinge and shelf areas have accounted for about 80% of the world's oil production. However, there is no reason why the deep basin could not be equally prospective and even the rim area may yield some Trenton synclinal fields. The density of exploratory Trenton tests in southern Michigan and southwestern Ontario is roughly one well per 40 sq. miles. This is contrary to the popular belief that this is a highly drilled area.

Only a few brief comments can be made at present on the applicability of various exploration tools for Trenton syncline prospecting.

. . . Seismograph. Fields of the Dover type where steep dips or even faulting are involved may be found with this method. Pools such as Scipio-Albion and Colchester where the total relief is less than 40 ft. would be extremely difficult to detect with the seismograph.

. . . Gravity. A regional gravity trend is coincident with the Scipio-Albion trend. This gravity trend is somewhat vague and is about three miles wide. There is a gravity trend in fair correspondence with Dover field; no distinct trend is associated with Colchester production. In general, gravity may be useful in outlining regional trends and prospective areas, but not for specific well locations.

. . . Aeromagnetic coverage is not available over the Scipio-Albion trend; however, the aeromagnetics over Dover and Colchester do not appear to show anything significant. The magnetometer may be of use regionally to interpret the basement complex in the hope of finding zones of basement weakness.

. . . Air-photo interpretations are

probably not applicable since the movements which created the Trenton structures had ceased by the close of Devonian time. Also, most of the area has a mantle of roughly 100 ft. of glacial drift which masks the bedrock structures.

... **Subsurface geology** is believed to represent the best exploration method. Oil and gas shows, anomalous dolomites, and suggested structural lows are considered the best indicators of nearby Trenton production. Colchester was found by offsetting a Trenton oil show and Albion could have been discovered by offsetting an old well on the eastern edge of the pool which encountered 55 ft. of anomalous dolomite. This well was not offset for 15 years. This case alone should be sufficient to emphasize the value of subsurface geology in Trenton exploration.

It is doubtful if detailed regional facies work with the Trenton would reveal any synclinal prospects because the required dolomitization is secondary and related to movements which occurred after Trenton deposition. In other words, the origin of these fields is believed to be controlled by structure rather than sedimentation.

Acknowledgment

Sincere appreciation is extended to the geological department of Humble Oil Co., Carter Division, Grand Rapids, who made the Scipio-Albion portion of this report possible by offering information and assistance. Gordon Fix and Tad Shea of Humble gave many worth-while ideas and suggestions which were instrumental in forming this report.

Maritimes Also Offer Oil, Gas Possibilities

In a paper presented at the recent western Canada regional meeting of the AAPG in Banff, H. L. Cameron, head of the geology department at Acadia University, pointed to two distinct possibilities for oil and gas exploration in the Maritime Provinces of eastern Canada.

One of these is the Mississippian, which includes the nonmarine Horton group (Lower Mississippian) and the marine Windsor group (Upper Mississippian). The Horton is the source of oil and gas produced at Stoney Creek field in New Brunswick.

The second possibility lies on the Continental Shelf. Here, seismic surveys have revealed chances for a Triassic basin capped by a thick Cretaceous cover. Sable Island, according to Cameron . . . "offers a drilling platform for exploratory work and possible production."

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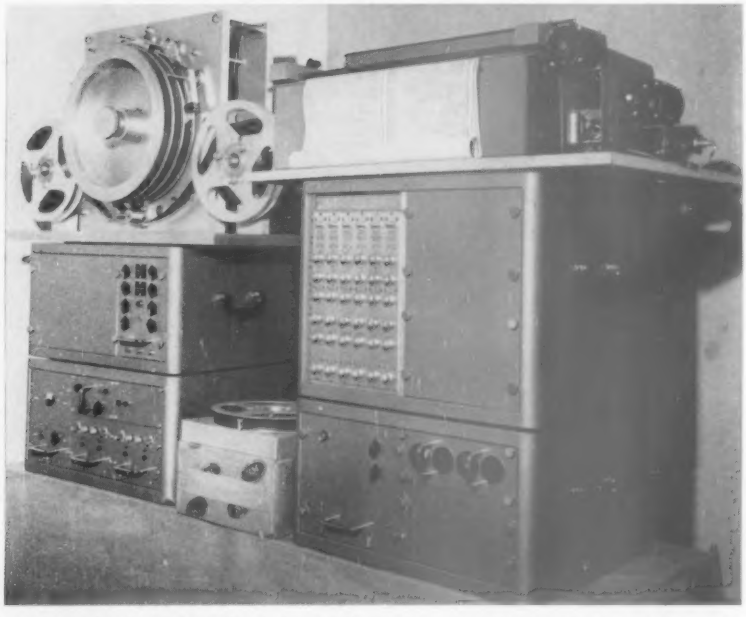
SHALLOW-DRAFT BOAT used for seismic surveying is converted LCVP landing craft.

Continuous seismic profiler

—a new Far North exploration tool

BY A. E. PALLISTER
Accurate Exploration, Ltd.
Calgary



RECORDING COMPONENT of the StraTometer is extremely portable and weighs 900 lb. Signal is composited on magnetic tape in upper left. Entire unit breaks down into six parts for transporting. A record section is coming off the machine. Fig. 2.

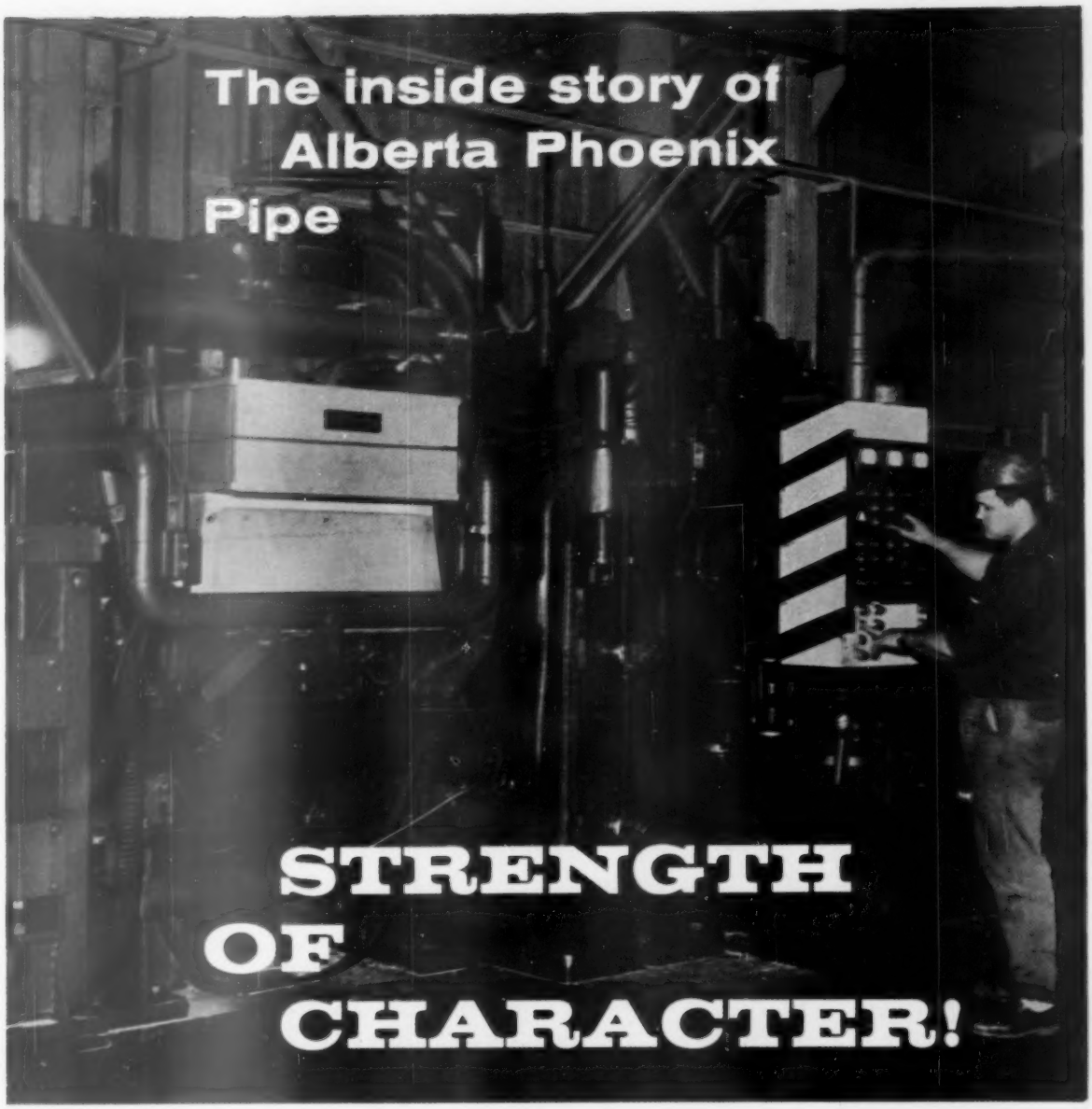
WHAT MAY PROVE to be the best approach for an exploration technique in the shallow sedimentary sections of the Far North and Canada is the continuous seismic profiler which has been developed by Accurate Exploration, Ltd., of Calgary.

It is especially adaptable in terrain that abounds with lakes and streams and accessible by small boat. The method is fast and economical.

Here's how it works: A boat tows a repeatable sound source and an abbreviated detector cable behind it. The sound waves are picked up and transmitted to a recorder which is compact and extremely portable. The entire crew consists of but three men: instrument operator, surveyor, and boatman. Yet this crew can obtain 40 miles of profile in a single day.

Called the "StraTometer," the method is particularly adaptable to mapping the subsurface sedimentary section beneath any body of water. Presently the instruments will record to depths of 4,000 ft. So portable is the equipment that it can be flown to remote lakes and a taxiing plane used in lieu of a boat.

The sound source is a repeating chamber using gas. The mixture of propane and oxygen is detonated in a submerged combustion chamber and this generates the sound waves. Low-frequency waves of the magnitude of 35 c.p.s. are emitted. Experimentation has shown that other mechanical sound sources previously used attenuate very rapidly and seriously limit the possibility of getting deep reflections. The history of continuous profiling



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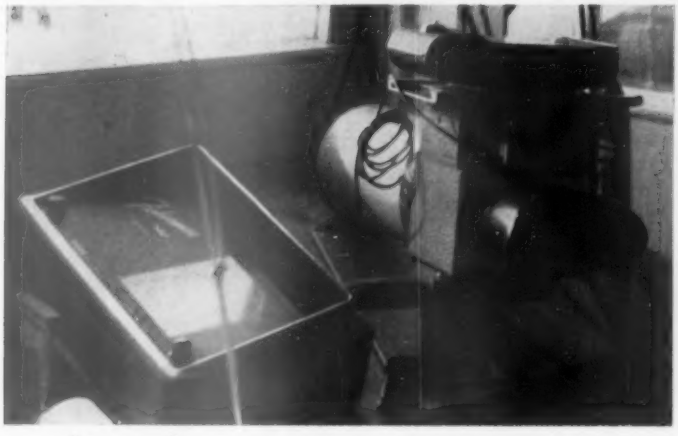
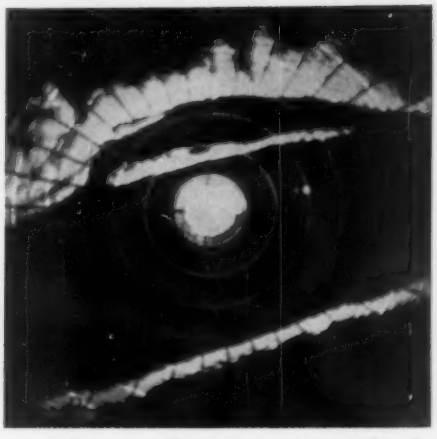
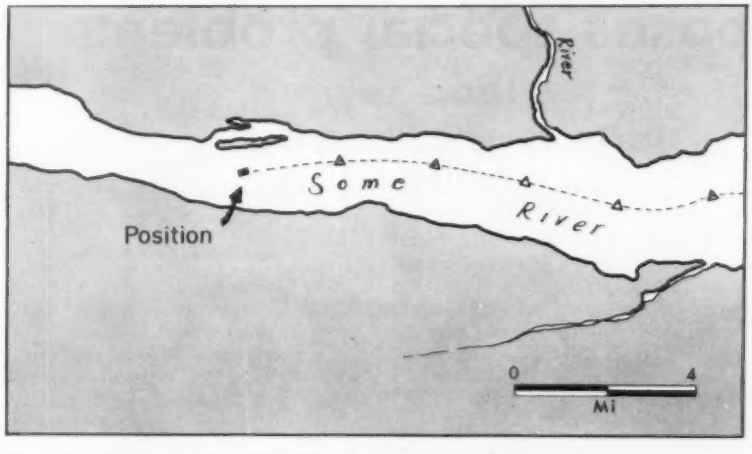


. . . this radar surveying instrument . . .



produces this image, which is photographed. Using the 0.2-mile concentric rings . . .



the boat's position is then transferred to a large aerial mosaic of the region.

methods points up the fact that a small sound source produced at rapid intervals has the tendency to duplicate the over-all effect of a large explosion. The aim is to create energy which is largely in the usable sound spectrum of less than 100 c.p.s.

After successful use of a repeatable gas explosion chamber as a sound source, results were improved by adding more exploders which fired simultaneously. These multiple exploders act very much the same as pattern shooting does on land. The normal detonation interval used was 2 seconds. The gas exploders were designed by Alpine Geophysical Associates.

Recording system components are compact. For detection and transmission of the sound waves abbreviated hydrophone cables are used. Four cables each have four hypersensitive phones on each side of the cables. This hydrophone grid provides a means of reinforcement of reflection signal and cancellation of random noise.

In order to obtain maximum depth resolution and further enhance the reflections, the signals received by each hydrophone group are recorded on individual magnetic tapes. These recordings are in turn automatically relayed so that the results of four explosions are composited. Since the explosions occur along the line at distances of every 12 ft. of profile, the effect is to provide a composite measurement of the reflected energy over a distance of 36 ft. as it is received by 16 hydrophones.

The results of the survey are instantaneously observable through the use of a variable-density continuous geologic cross-section. This feature enables the operator to detail areas of interest displayed on current shooting immediately after they are shot. The recording equipment was designed by Accurate Exploration.

Surveying is a relatively simple process. The basic components of the surveying equipment consist of a portable short-range radar set, a recording camera, surveyor, and aerial photographs. The radar screen shot of the boat's local position on the body of water is continuously photographed on a Polaroid camera. From the known-distance concentric-line patterns, the position of boat from local distinguishing landmarks can be plotted and relocated on smaller-scale aerial mosaics.

This exploration tool has been used primarily in Canada's Northwest Territories and in the Arctic Ocean area. There the method is ideally suited due to the abundance of water, remoteness of locale, and the relatively thin sedimentary section.

The main attraction of the StraTometer in this north country is that rapid inexpensive reconnaissance is done at one-fourth the cost of conventional seismic techniques. Here in the land of vast acreage reservations the method can point up the sectors of prime interest which warrant further investigation. The geologist and the geophysicist using the most efficient mode of transportation—the float-equipped aircraft—are then able to evaluate surface work further prior to planning land seismic programs.

WOODED and mountainside locations, as here at Savanna Creek field, often present a problem in transporting chemicals and heavy-duty pumping equipment to the well site.

Well servicing in Canada poses special problems

BY C. R. OLSON AND L. H. STEWART
Dowell of Canada, Ltd., Calgary

WELLS ARE WELLS and they are beset by the same problems, and respond to the same stimulation methods, the world over. Hence, chemical well-servicing techniques, and the field equipment required for their performance, do not differ greatly between western Canada and the United States. However, there are a few fundamental differences in the two areas; differences which sometimes prove exasperating to service company engineers.

Operational Differences

One factor having a profound effect on Canadian well-servicing operations is geographical vastness. Wells are scattered farther apart and considerably more time is usually required to reach a location. For example, there are currently 155 active rigs operating in western Canada, as compared to 1,181 rigs in an equal area of the southwestern United States.

CANADIAN OPERATIONS require a new perspective toward the distance factor. More time is lost on the road when locations are hundreds of miles apart.

Distance ups costs. This means that stations, for storing chemicals, cementing materials and mechanical supplies, and maintaining service equipment, must also be spread over a much wider area. For example, 14 Dowell of Canada stations service an area which justifies 44 stations in the United States' Southwest. As an illustration of the distance involved, Dowell locations at Virden, Man., and Fort Nelson, B. C., are as far apart as Houston and New York City. This means that men and equipment must lose more time on the road, supplies must be hauled farther, and treating costs in general go up.

The "chill factor." Climate is another factor that exerts a profound influence on well-servicing operations, especially during the winter months. Although temperatures of 40° below zero do not ordinarily require the suspension of service work, they do demand special planning and precautions. In many areas, blizzard conditions combined with subzero temperatures result in deep snows which immobilize service equipment. In

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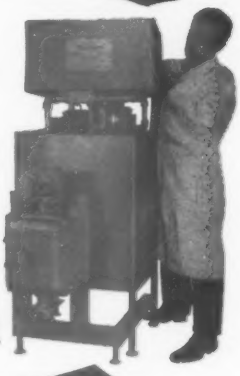

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IT'S BAD ENOUGH IN DAYTIME, but round-the-clock operations in temperatures 40° below or so really emphasize the "chill factor," as reflected in the faces of these Dowell men.

BLENDING and pumping equipment are hooked up for a fracturing job at Drayton Valley, Alberta. The remote control panels shown in the foreground . . .

. . . and as seen in this closeup, regulate the high-powered Allison engines which provide the horsepower needed to perform the stimulation treatment.

addition, they create a chill factor which makes it impossible for service personnel to work in the open.

And road bans. Location accessibility often presents a problem in Canada. The sparse population has occasioned a rather limited highway-development program with comparatively few miles of hard-surfaced roads. In effect, there are no all-weather roads, in that road bans are applied for periods usually totaling from 1 to 2 months of each year, with drastic load limitations. Spongy field roads communicating with the main arterial highways are often impossible or uneconomic to maintain. Well sites are frequently located in practically inaccessible surroundings, varying from mountainsides to muskeg locations.

These problems are dealt with daily by the Canadian petroleum industry, with astonishing matter-of-factness. From the service-company standpoint, however, area, climate, and terrain combine to produce an unhappy economic situation in which service equipment can only perform about 50% of the jobs this same equipment could perform in United States oil-field areas. The resultant higher operating costs must be compensated for by unavoidably higher service costs than those in effect in the United States.

Technical Differences

Although field techniques are essentially similar in Canada and the United States, a few differences have evolved as a result of special conditions encountered in the various regions of the Canadian oil fields. In

cementing for example, five different types of cementing equipment have evolved over the past 20 years and are presently in use to meet specialized field requirements. Because of widely separated bulk-plant locations, a great deal of sack cement is used in Canada. Cementing units are designed to proportion admixes to sack cement accurately.

Low surface-hole temperatures are a peculiarly Canadian problem. Temperatures of less than 40° F. are frequently encountered, and as low as 8° above zero has been recorded in surface holes in the permafrost. Thermochemical methods of overcoming this problem are being devised and experimentally evaluated, and it is hoped that an economical solution will soon be commercially available.

In the field of **well stimulation,** western Canada is essentially "acid country." Devonian reservoirs alone account for approximately 60% of crude reserves. The major acidizing problem is that of obtaining more effective cleanup of drilling, cementing, and lost-circulation materials in porous reef zones. Another problem is that of obtaining better vertical distribution of acidizing benefits in the extremely thick, low-porosity carbonate reservoirs.

Use of the recently developed "acid guide" has made possible preliminary planning and design of acid treatments based on specific reservoir characteristics and sound engineering principles. Results of such treatments have shown considerable improvement, and have provided considerable savings to well operators through avoiding treating techniques which would result in premature acid spending or ineffectual application.

One problem that besets some Canadian oil operations is an extremely severe **hydrogen sulfide corrosion** problem, perhaps the worst in the world. This condition must be recognized and suitable modifications in chemicals and additives made to compensate for it. The frequent occurrence of residual hydrocarbon deposits makes emulsion difficulties more prevalent in the Canadian area than in U. S. oil fields. A number of extremely efficient demulsifying agents have been developed to meet this problem, and numerous tests are run in the Calgary laboratory on various samples of local crudes to determine which agent will be most effective in a specific crude.

Fracturing techniques have been notably successful in the Upper Cretaceous (Pembina and Medicine Hat, for example). Results of fracturing treatments in the Lower Cretaceous, Jurassic, Triassic, and Devonian have been erratic from the standpoint of profitable production increases and length of time required for payout. Fracturing pressure gradients in this area do not always conform to those recorded in the Mid-Continent area, and screenouts sometimes plague service-company engineers.

Constant improvements in service equipment and treating procedures, and the use of auxiliary techniques, such as the recently developed Abrasijet (sand-fluid jetting) have largely overcome some of these specialized problems in the Canadian area. Results are now being obtained that are comparable with those normally expected in the Paleozoic formations of the Mid-Continent area. As a result, during the past few months, the use of fracturing techniques has had a tremendous proportional increase, when compared with the more conventional acidizing techniques normally employed in this area.

Canadian well servicing does present its specialized problems, but as long as well operators and service-company engineers cooperate to solve these problems, and display the ingenuity that has long characterized the petroleum industry, none of these difficulties should prove insurmountable.

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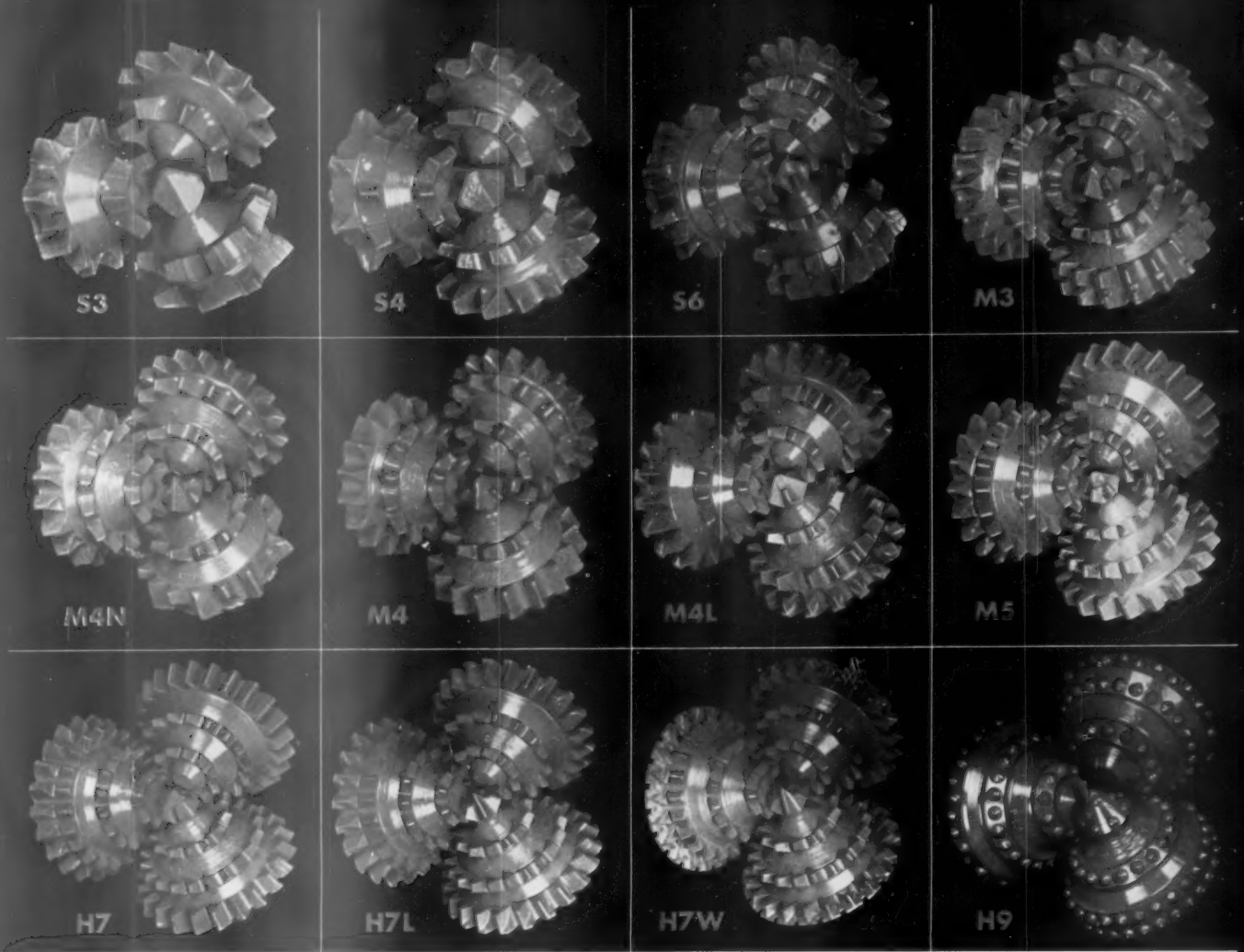

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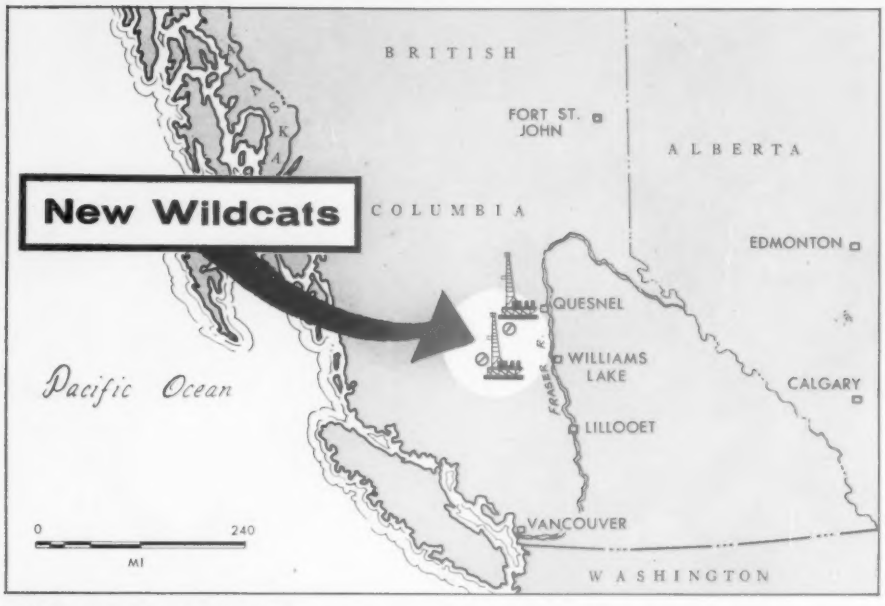

WHAT ARE THE POSSIBILITIES for oil or gas in the remote Fraser River country? This is the question now foremost in the minds of some oil finders as . . .

Canadian explorers ponder new province in Central British Columbia

BY HANS P. TRETTIN
Geologist, D. Bruce Bullock & Associates, Calgary

Recent commencement of two remote wildcats in South Central British Columbia has focused the oil industry's attention on the Fraser River region as a potential oil and gas province.

Just how good are the chances for oil and gas discovery here? Perhaps the experience and findings of the author can shed some light on the subject. Surface reconnaissance in the Lillooet-Big Bar area tells a story of stratigraphy and structure that can serve at least as an introductory chapter to the geology of this new wildcat target.

MUCH of the interior of British Columbia is covered by Tertiary volcanic rocks, but there are good exposures of older rocks along the deeply incised valley of the Fraser River in the vicinity of Lillooet and Pavilion. The stratigraphy and structure of this area are not identical with those of other regions in Central British Columbia, but they show what type of geology we are dealing with and what the chances for the accumulation and preservation of oil and gas may be.

The first part of this paper briefly describes the general geology and geological history of the Fraser River area between Lillooet and Big Bar. The second part deals with the chances for oil and gas and with technical problems of exploration—at first in the Fraser River area and then in Central British Columbia in general.

Stratigraphy

The oldest rocks in the Fraser River area belong to the Middle and Upper **Permian** Marble Canyon formation which is the upper part of the widely distributed Cache Creek group. In the southern Bowman Range this formation is approximately 6,000 ft. thick. About 2,500 ft. is made up of limestone; the remainder consists of ribbon chert, argillite, tuff, and volcanic flows. Some of the limestone is interbedded with ribbon chert and forms extensive deposits of fairly regular thickness, but most of the limestone is present in thick. massive, lenticular units that range from 100 ft. to several miles in length.

Locally, these limestones contain colonial corals and algae (?) together with remnants of echinoids, and fusulinids. With respect to the lenticular shape of the deposits and the presence of possible reefbuilders, there limestones resemble bioherms but the porosity is generally low, and the rocks are mostly massive, dense, and microcrystalline.

The Marble Canyon formation is folded and faulted. Massive units show broad open folds that are severely disrupted by faults. Thinbedded cherty and argillaceous units are tightly folded.

The Marble Canyon formation is overlain by the **Triassic** Pavilion group in which two divisions are recognized. The lower division comprises several thousand feet of ribbon chert and argillite and a smaller proportion of limestone, volcanic rock, and lithic sandstone. The upper division, several thousand feet thick, is made up dominantly of lithic sandstone, volcanic rock, and argillite and to a minor extent of chert, limestone, and conglomerate. Graded bedding and penecontemporaneous deformations are

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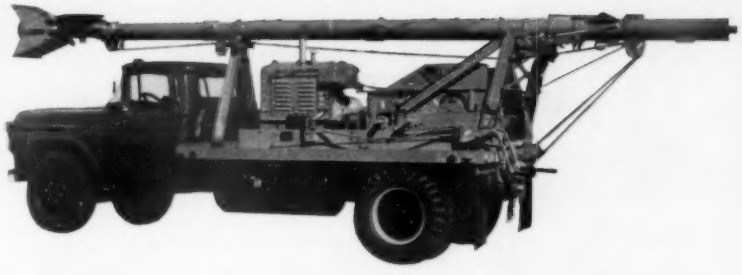

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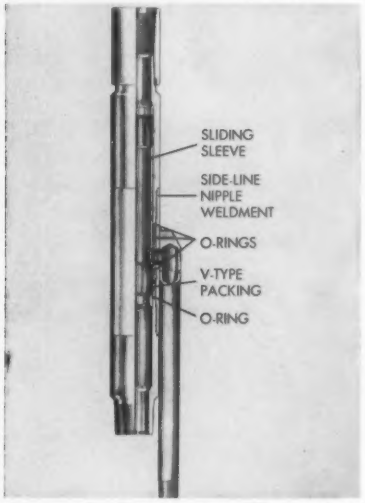
OTIS PRODUCTION NEWS

Volume II, Number 2 **Otis Engineering Corporation • Dallas** *Production Equipment and Services*

New Otis Cross-Over Tool Solves Zone Feeding Problem In Single String Dual Completions

Sliding Side-Door® With Special Weldment Provides Complete Zone Isolation With Cross-Over Chokes Out of Well

CORPUS CHRISTI — Another downhole completion and production problem has been solved by Otis Engineering Corporation with the development of a new type of cross-over tool. The new tool is essentially a Type A Otis Sliding Side-Door to which has been added a special one-inch pipe weldment on one side of the outer mandrel, in place of



the usual slotted ports. The tool is designed to be made up in the tubing with a short tubing sub and Type S Otis Landing Nipple above it and a tubing sub and Ported Landing Nipple below it, and then set in a dual or by-pass type packer. When installed with a Type SS Otis Plug Choke set in the ported nipple, the sleeve may be opened to permit production from the upper zone to be brought into the tubing through the one-inch pipe weldment while flow from the lower zone is directed into the annulus.

See schematic well diagram — right

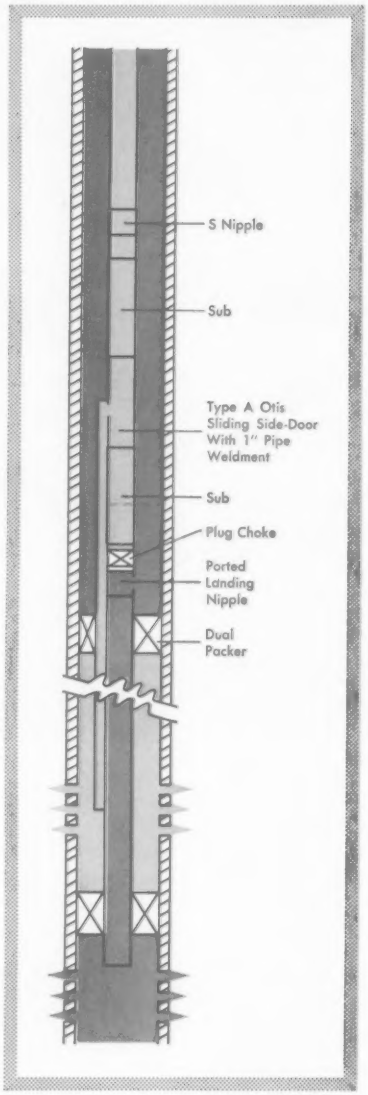
If desired, a straight flow choke may be landed in the assembly to permit production of the lower zone through the tubing while flow from the upper zone is produced through the annulus.

This new Otis Sliding Side-Door Cross-Over was developed at the request of a progressive Texas-based producing company which had experienced extended periods of lost production from the low pressure zones in its single string dual completions after changing a cross-over choke in conventional cross-over equipment, or when a choke had been out of the well for a short period of time for various types of wire line work. This loss of production proved to be the result of the high-pressure zone feeding the low-pressure zone.

According to the company, the new Otis Sliding Side-Door Cross-Over not only proved effective in solving its zone feeding problems, but it has also eliminated the need of having a pump truck on location to equalize pressure across the two zones — as was frequently necessary before the choke could be removed from conventional cross-over equipment. The company also reports it has successfully fractured the upper zone of a number of its wells through the one-inch pipe without damaging the tool.

The Type A Otis Sliding Side-Door, from which this new type of cross-over was derived, is a circulating and production tool which is used downhole to provide selective communication between the tubing and the annulus. The tool has a ported sleeve which is designed to be moved up or down within a ported mandrel. The sleeve may be shifted by one of two ways: 1) by standard wire line methods, or 2) by pumping down an expendable shifting tool. V-type packing and O-rings are used to provide a positive seal between the sleeve and the mandrel when the sleeve is closed.

The new Otis Sliding Side-Door Cross-Over is another example of the ingenuity of Otis' well completion specialists in the field and its engineering department in Dallas. Literally thousands of production problems of this nature have been solved by Otis over the past 32 years. For more information on the new Otis Sliding Side-Door Cross-Over, or for help with any specific production or completion problem, call the Otis office nearest you or write Otis, Dept. 2-W, Box 35206, Dallas 35, Texas. You will find your Otis specialist ready to help you — anxious to serve you.



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AGE	ROCK UNIT	POSSIBLE SOURCE BEDS	POSSIBLE RESERVOIR BEDS	ENVIRONMENT	TECTONISM
MIDDLE TO LATE TERTIARY	OLIVINE BASALT SEDIMENTARY ROCKS		X	CONTINENTAL	
EOCENE - OLIGEOCENE	FRENCH BAR FTN.		X	"	
LOWER CRETACEOUS	KINGSVALE GROUP		?	"	INTERMITTENT BLOCK FAULTING
" "	SPENCES BRIDGE GP.		?	"	
" "	JACKASS MTN. GP.	X	?	MOSTLY MARINE	OROGENY
" "	LILLOOET GROUP	X		MARINE	
JURASSIC					OROGENY ?
UPPER TRIASSIC					"CASSIAR" OROGENY ?
TRIASSIC	PAVILION GROUP	X		"	OROGENY ?
MIDDLE AND UPPER PERMIAN	MARBLE CANYON FTN.	X		"	

POSSIBLE SOURCE and reservoir rocks are present throughout most of the stratigraphic column of South Central British Columbia. Fig. 2.

common in the sedimentary rocks. There may be a major unconformity—either at the base or somewhere within the Pavilion group—but it is not exposed in the areas studied.

The Pavilion group shows a pattern of structural deformation similar to the Marble Canyon formation. It is intruded by igneous rocks of various types and ages: Upper Triassic (?) ultrabasic dikes and sills of Jurassic or early Cretaceous age; and basalt and dolerite dikes and sills that range in age from Mesozoic to mid-Tertiary. The quartz-diorite stocks have contact-metamorphic and metasomatic aureoles which measure hundreds of feet in thickness. In the vicinity of the small intrusions, narrow zones of hornfels have developed.

The **Jurassic** system is not represented in the Fraser River area.

The lower part of the **Lower Cretaceous** series is characterized by great thicknesses of sedimentary rocks. Two major stratigraphic units are recognized: the older (Neocomian?) Lillooet group and the younger (Barremian?) Jackass Mountain group.

The Lillooet group consists, in the lower part, mostly of argillite and siltstone and in the middle and upper parts of the same rocks with an increasing proportion of lithic sandstone and granule conglomerate. Graded bedding and penecontemporaneous deformations are very common. The exposed portion of the group has a minimum thickness of 6,400 ft. The true thickness probably is much higher. The group is tightly folded and is intruded by quartz-diorite dikes and sills of early Lower Cretaceous age.

The Lillooet group is unconformably overlain by the Jackass Mountain group which has been subdivided into three major units called Division A, Division B, and Division C.

Near the mouth of Bridge River three members are recognized in Division A. The lowest member, about 150 ft. thick, is composed of lithic sandstone with plant remains and of conglomerate. The middle member, 1,000 to 1,500 ft. in thickness, consists mostly of lithic sandstone. The upper member, approximately 1,000 ft. thick, contains argillite and siltstone which are fossiliferous and rich in carbonaceous matter and lesser amounts of lithic sandstone and limestone. This unit is interesting as a possible source rock of oil and gas.

Division B of the Jackass Mountain group ranges from 1,000 to 1,800 ft. in thickness and is made up of conglomerate, lithic sandstone, and minor argillite.

Division C which has a minimum thickness of 5,000 ft. consists, in order of abundance, of lithic sandstone, argillite, and conglomerate.

Graded bedding which is common in the Pavilion and Lillooet groups is generally absent in this group. The Jackass Mountain group is broken into several fault blocks by normal faults of regional extent. Folds are broad, open, and comparatively rare. The Jackass Mountain is the youngest stratigraphic unit in the area which is partly marine. All rocks younger than mid-Lower Cretaceous are continental.

Strata ranging from **mid-Lower Cretaceous** to **mid-Tertiary** in age have been assigned to various stratigraphic units such as the Spences Bridge group (Aptian), the Kingsvale group (Albian), the Ward Creek assemblage (Cretaceous or early Tertiary), and the French Bar formation (Eocene-Oligocene), but these have many characteristics in common. They consist mostly of volcanic rocks and to lesser extent of sedimentary rocks which locally include some lignite. The volcanic component shows a great variety of rock types but is dominated by andesite.

Lithological correlatons over larger distances are mostly impossible. Stratigraphic correlations have to be based on plant fossils in associated sediments, but unfortunately the chronology of these fossils has not yet been firmly established.

Most of these Cretaceous and early Tertiary units are thousands of feet thick, but exact total thicknesses cannot be obtained because of faults, insufficient exposure, or the massive character of the rocks. As these are continental deposits numerous unconformities are probably present. These units have been affected by the same fault movements as the Jackass Mountain group. In most localities the strata dip gently—only in the vicinity of major faults have they been tilted into almost vertical positions.

Middle to late Tertiary strata consist of several hundred feet of fluviatile sandstone, conglomerate, and minor shale, overlain by approximately 200 ft. of olivine basalt. The strata rest almost horizontally and were deposited after the Fraser River fault zone ceased to be active.

Geological History

In Upper Permian time it seems probable that a reef-zone extended through Pavilion Mountains and Bowman Range and continued northward into the vicinity of Williams Lake. This zone may have fringed an Upper Permian land mass located to the east.

The older deposits of the Pavilion group, consisting of argillite and radiolarian chert are indicative of relatively stable conditions. Because of the preservation of comparatively abundant carbonaceous matter the environment may be classified as a "restricted" marine basin. The younger rocks indicate vulcanism and tectonic movements. The Triassic history of the Fraser Valley is not yet fully understood as we are still uncertain about the existence and stratigraphic position here of a major unconformity which has been observed in the northwestern parts of British Columbia. An orogeny may have taken place after the deposition of the Marble Canyon formation or sometime during the deposition of the middle or upper part of the Pavilion group. The presence of the Upper Triassic (?) ultrabasic intrusions in the younger parts of the Pavilion group, however, suggests that another major orogeny took place after the sedimentation of the Pavilion group.

No Jurassic volcanic or sedimentary rocks are exposed in the area. The

sandstones of the Lower Cretaceous Lillooet and Jackass Mountain groups, however, were derived from albite-rich volcanics of a probable Jurassic age. A major orogeny culminating in the intrusion of the Mount Lytton batholith and related stocks probably took place in the Jurassic.

In the earliest Lower Cretaceous, during the deposition of the lower part of the Lillooet group, the area probably was part of a restricted marine basin which was tectonically unstable. During the sedimentation of the upper part, the area gradually rose. Subsequently the rocks were folded, intruded by dioritic dikes, elevated above sea level, and eroded.

The basal conglomerate of the Jackass Mountain group is of continental origin. The middle and upper members of Division A were laid down in a marine basin which was first depressed and then gradually elevated. The thick conglomerate of Division B is the earliest evidence of movements on the Fraser River fault zone which continued intermittently to the Middle Tertiary. This faulting may be related to the isostatic rise of adjacent batholiths. A complex graben was produced which probably controlled the sedimentation of Divisions B and C of the Jackass Mountain group. These units probably originated in a narrow elongate trough which subsided rapidly with respect to the bordering mountains but fluctuated with respect to sea level. At times it may have been connected with the open sea, more often it formed a restricted marine basin, and temporarily it may have been a continental valley occupied by a large river.

In the mid-Lower Cretaceous time the area finally rose above sea level.

From late Lower Cretaceous to mid-Tertiary time, great thicknesses of volcanic rocks, dominantly andesite, were laid down that are locally intercalated with river deposits. The flows may have ascended through fractures associated with the Fraser River fault zone.

In middle and late Tertiary time we find fluviatile sediments that may outline the ancestral Fraser River. The widespread appearance of olivine basalts marks the end of a volcanic period that was dominated by andesite.

Oil and Gas Possibilities

What conclusions concerning the petroleum possibilities of the area can be drawn from this information?

Possible source rocks for oil and gas are not uncommon in the stratigraphic column. The black argillites of the Marble Canyon formation, of the Pavilion group, and of the Lillooet group all contain carbonaceous matter. Particularly rich in carbonaceous matter is the fossiliferous middle member of Division A of the Jackass Mountain group. The rocks of mid-Lower Cretaceous and younger age, on the other hand, are probably unfavorable as source rocks because they originated in continental environments. The organic matter of these rocks is partly preserved as lignite.

Porous sandstones and conglomerates ranging from early Lower Cretaceous to middle or late Tertiary age can be considered as possible reservoir rocks. Particularly the continental lithic sandstones of mid-Lower Cretaceous and younger age are favorable because of their high porosity.

What are the chances for the accumulation and preservation of economic quantities of oil and gas?

The Permian and Triassic rocks of the Cache Creek and Pavilion groups were involved in several orogenies that took place in the Triassic, Jurassic, and early Lower Cretaceous; furthermore they were affected by the intermittent block-faulting between mid-Lower Cretaceous and mid-Tertiary time. Any large quantity of oil and gas that may have originated in these rocks probably has escaped during one of the various periods of deformation.

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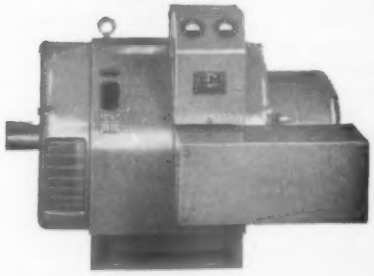

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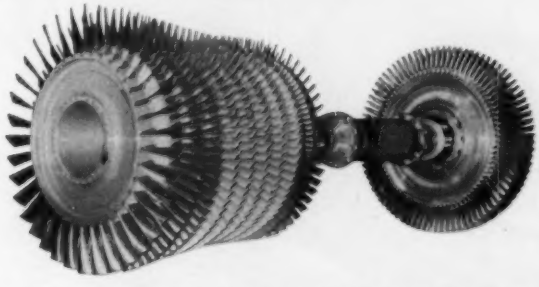

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In contrast to these older rocks, the strata of the Neocomian Lillooet group have undergone one major period of folding, the early Lower Cretaceous orogeny. However, the fold structures in this group are extremely complex. It would be very difficult, if not impossible, to find a major dome, to locate its high point, and to estimate the reservoir volume. And oil that may have originated in the Lillooet group could have been destroyed in the period of erosion that followed the folding; or it could have escaped through fault zones that developed in Cretaceous and early Tertiary time.

The petroleum possibilities of the Fraser River area are therefore practically restricted to source rocks that are younger than the last great orogeny in the early Lower Cretaceous and older than the mid-Lower Cretaceous uplift which has produced continental conditions from the Cretaceous to the present. The middle member of Division A of the Jackass Mountain group, a unit rich in carbonaceous matter, has the age and the qualities required for a source rock in this area. Oil from this unit too may have escaped through fault zones. But there is a small chance that some oil generated in the Barremian may have migrated into stratigraphic traps formed by Cretaceous or Tertiary fluviatile sediments.

Chances are slim. We may conclude therefore that the chances for the preservation of economic quantities of oil and gas are poor in the vicinity of the Fraser River valley. If exploration were undertaken it should be concentrated on Cretaceous or Tertiary fluviatile sediments. As mentioned before, the stratigraphy of these ages is difficult to handle, because we are dealing dominantly with volcanic rocks.

Now a few statements about the chances and problems of petroleum exploration in Central British Columbia in general.

Possible source rocks and possible reservoir rocks of oil and gas are probably present in most parts of British Columbia. But the degree of deformation of early Tertiary and older rocks is higher than in most of the oil producing areas of the world. Because of these deformations and several periods of uplift and erosion it seems that Central British Columbia is less favorable for oil exploration than, for example, large parts of the Yukon and Northwest Territories.

Furthermore, exploration will encounter many technical and geological difficulties:

- It will be impossible to measure total thicknesses of various rock units and to establish a complete stratigraphic column.
- Photogeologic studies will prove less reliable than in the Canadian North owing to a widespread cover of glacial deposits and to structural and stratigraphic complexities.
- The same complexities will render difficult the adequate interpretation of seismic records.
- Another hindrance to seismic work is the locally rugged topography.
- In drilling wells, great thicknesses of volcanic rock and chert may be encountered.

The only advantages of the area are its accessibility and the proximity of Vancouver as a base of supplies and a possible market.

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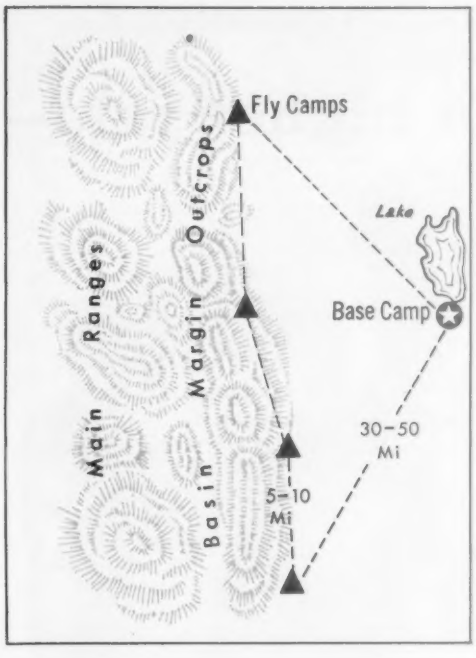

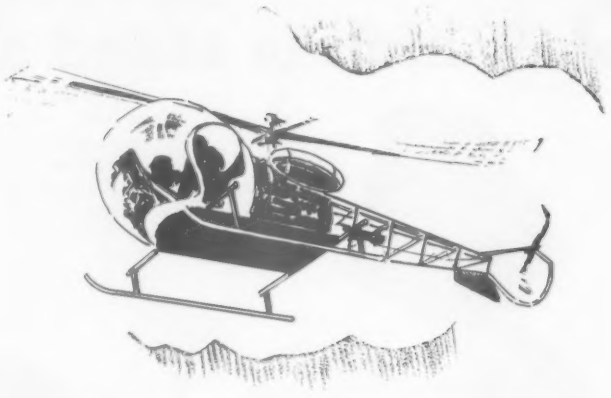

OPERATING PLAN of helicopter geology is to have a base camp on the edge of a lake so that it is supplied by heavy fixed-wing aircraft. From the base camp the helicopter supplies the respective fly camps and each field crew is flown to and from its daily work area from fly camps as often as necessary. Extreme mobility is the basic concept.

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Discovery confirms theories. All these problems are compounded by the fact that a key discovery in 1959 by Western Minerals, Ltd., has sparked a new wave of lease applications. This discovery has enhanced the apparent oil and gas possibilities of the land that lies within or near the Arctic Circle one-thousand fold.

Geologists have long looked with favor upon the oil possibilities of the Yukon and the Northwest Territories. Preliminary field surveys have mapped large surface anticlines. Geologists have measured sedimentary sections that exceed 20,000 ft. in thickness. The area has all the earmarks of a new petroleum province that could blossom into a major oil and gas reserve.

But the problem that has long plagued the geologist has been that of mapping this potential oil and gas province. Fortunately, the helicopter has supplied the key to unravel the geologic mysteries of the Yukon and the Northwest Territories.

Ferried by helicopters, surface geologists can now map in one season, prospects and concessions that would require 5 or even 10 years with old mapping techniques. In many instances some of the more remote areas could never be reached except by the helicopter.

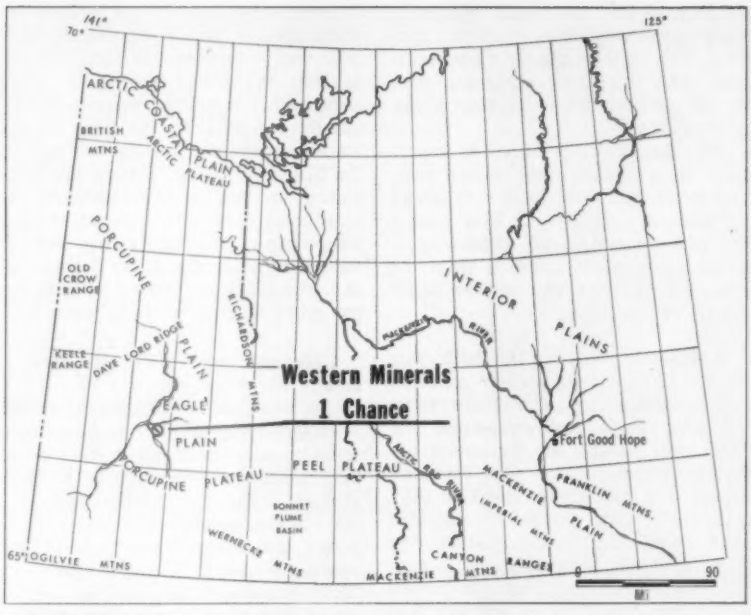
Helicopters enable geologists to devote as much as 95% of their field time to actual mapping and spend as little as 5% in travel. In the past many surface parties have spent 85% of the field season in travel to and from their work and have been able to devote only 15% of the total field season to geological mapping.

Cost comparison favors helicopter. Helicopter geology is an inexpensive exploration method for mapping remote and inaccessible prospects. The author's experience and that of other geologists reveals that the cost of the helicopter method can be a fraction of the cost of geological mapping using standard surface methods with jeep transportation, pack trains, or a combination of canoe and back-pack.

Table 1 shows how inexpensive it is to operate a helicopter field party. Compare these figures with seismograph costs in the muskeg of $50,000 per month. Charles B. Hunt, with the U. S. Geological Survey, in a recent article in April 1960 GeoTimes, reports that he was able to map 200 sq. miles in approximately 15 hours of flying time. He estimates that conventional mapping techniques would have required at least 9 months and probably 12 months with a geologist and a field assistant. Hunt's experience is substantiated by the work of the Geological Survey of Canada.

D. Bruce Bullock also confirms these results and points out one instance where a surface party spent 6 weeks in summer field work. Of this time only 3 or 4 days were spent on actual geological field work.

In 1959 the author's helicopter party covered 100,000 sq. miles in approximately 90 days. Total cost of the party, including the helicopter and the geologists, was approximately $100,000. The survey cost was on the order of $1.00-2.00 per sq. mile using aerial photographs and topographic base maps already in existence. Approximately 50% of the area was mapped in some detail. The remainder was checked using existing geological reports and other information available to the geologists. In this particular area, the Peel Plateau, much of the central part of the plateau is covered with Cretaceous beds and was not mapped in great detail. The remainder of the area mapped cost



VAST AND RUGGED PORTIONS of the Northwest Territories are especially suited for exploration by helicopter geology. Since the indicated discovery of the 1 Chance well, activity in leasing and exploration has snowballed.

when the going is tough

an estimated $2 per sq. mile to map in considerable detail.

One major oil company made a cost study comparing helicopter operations with conventional surface mapping methods in a remote area of Wyoming. On this particular prospect, the helicopter parties were able to map 4,500 sq. miles in detail in a 90-day period. Previously, the same area had been mapped by government parties over a period of 16 years.

Effective economic ratio. On a daily basis, the costs are much greater to operate a helicopter geological party in the field when compared with conventional mapping techniques. However, helicopter parties can operate at a much lower cost per acre than the typical surface party because of the ease of access and the much greater area mapped in the same length of time.

The decided cost advantage plus the tremendous time advantage gives helicopter surveys a huge effective economic ratio over conventional surveys. This EER ranges from as little as 10:1 to 150:1 or better depending upon the remoteness of the area, its accessibility, length of field season, weather, etc.

Equipment and personnel. During 1959 the author's helicopter party consisted of 13 men: 4 geologists, 3 geological assistants, 2 pilots, 1 mechanic, 1 cargo man, 1 cook, and 1 cook's helper. The party operated on the Peel Plateau, approximately 1,200 miles northwest of Edmonton, a basin lying at the foot of the Mackenzie and Richardson mountains.

It was absolutely essential to have a conventional fixed-wing airplane to supply the base camp from the nearest supply town, Fort McPherson. D. Bruce Bullock & Associates, the Calgary consulting firm that employed the helicopter party, provided a float plane, a Norseman, for this purpose. Actual flight operations, both fixed-wing and helicopter, were handled by the firm, Bullock Wings and Rotors Ltd., Calgary.

One helicopter, a Bell model 47 G-2, was able to service the four geologists and their assistants during actual mapping. If weather permitted, the geologists would spend 6 days at fly camps away from the base camp, mapping outcrops and measuring stratigraphic sections.

Advantages of fly camp operations. Fly camps in the Far North are two-men subcamps sites that are set up away from the main base of operations for limited periods of time. In other areas these subcamps have even been called "spike" camps.

Fly camps insure maximum efficient use of the helicopter. As a rule, a base camp is set up on a lake that is large enough to accommodate the float plane. Then fly camps are established along the mountain front at

BY DR. JACK A. WALPER

. . . associate professor of geology, University of Tulsa. Walper was born in Canada and attended Mount Royal College in Calgary, Alta. He transferred to University of Oklahoma where he was awarded both his BS and MS degrees in geology. In 1958 he received his PhD in geology from University of Texas and his thesis was based upon surface geological work in Guatemala. Dr. Walper has had considerable experience on the North American Continent in surface geological mapping. In the summer of 1959 he headed a helicopter party that operated in the vicinity of the Arctic Circle mapping geologic structures and stratigraphy. This summer he is again working in the Far North as head of a geological helicopter party. In these Canadian ventures, he is associated with D. Bruce Bullock & Associates, consulting geologists, Calgary, Alta.

In remote and inaccessible areas . . .

Here's what a helicopter geological party can do

- Map prospects easily, quickly, and safely.
- Measure stratigraphic sections.
- Collect rock and paleontological specimens for subsequent examination and laboratory identification.
- Map detailed or reconnaissance surface geology using either aerial photographs or topographic sheets.
- Rapidly check previous geological work and tie in local geology with the major regional features.

. . . All this at a fraction of the cost for comparable surveys using conventional field mapping techniques and transportation!

the margins of the basin; these camps are usually in or near canyons where geologists can map outcrops and measure sections easily. The fly camps normally are all within 30 or 50 miles of the base camp and are strung out along the outcrops that mark the mountain front. These fly camps normally are 5 to 10 miles apart; but as the geologists work towards each other, the camps may be separated only by a ridge or two.

Field experience in 1959 revealed that one helicopter could easily service four fly camps. However, as a rule, only three geologists and their assistants were actively mapping in the field. The fourth geologist acted as a coordinator. In this capacity he laid out future plans of operation, selected sections for measurement, spotted outcrops, and checked aerial photographs against the geology on the ground. He also was in charge of the helicopter operations and laid out the schedule for the daily helicopter flights. Normally, as chief of party, the coordinator visited each fly camp daily, checked over the previous day's work, and planned the future work for the particular party involved.

Experienced personnel a must. The coordinator's previous helicopter experience plays a dominant role in the optimum use of the helicopter and the efficient running of the party itself. And, of course, it is desirable that both the helicopter pilots and the geologists have experience in helicopter mapping operations. The use of inexperienced personnel to cut down the cost of the operation inevitably results in a higher over-all cost of the survey because of the inferior quality of the mapping or the loss of time due to the inexperience of the geologists or the pilots.

Logistics. The next most critical item in helicopter operations is an adequate supply of aviation gasoline. Inevitably this calls for long-range planning. Most companies barge or fly their gasoline stock in and leave it at a main cache that is within easy flying distance of the area to be mapped. Some companies will even bring in their gasoline stock the previous fall or late the previous summer. The fixed-wing plane can then fly the gasoline from the main cache to base camps.

An adequate food supply is important. As a rule the local trading posts and small stores are alerted to insure an adequate supply of food during the summer operation. Otherwise, it is necessary to fly food in from the nearest large town and this can be an expensive operation.

Communications . . . All helicopter parties in the north country maintain radio communication with the nearest government short-wave-radio station, even though the fly camps are not in radio contact with the base camp. The base camps check in daily with the nearest government-operated short-wave-radio station. Usually the base camp maintains daily contact with all other base camps in the immediate area regardless of whether they are operated by the same company.

Factors affecting helicopter operations. The weather is the biggest single deterrent factor that affects helicopter geological parties. It is not unusual in the Far North to have low clouds set in and prevent flying for several days, or even a week. Bad weather will seriously restrict or curtail the operations of the fixed-wing aircraft.

Frequently when the clouds obscure the mountains and prevent helicopter operations at the higher levels, the river valleys and the low areas can be worked. When bad weather is prevalent over a large area, operations are usually confined to the base camp. Two-man parties are then sent out in the helicopter at the start of the day, picked up late in the afternoon of that same day, and returned to the base camp. Or if the weather takes a sudden turn for the worse during the day, the helicopter pilot will pick up the party and return it to camp.

Universal application in remote areas. The helicopter is a real boon to the exploration geologist when he is called upon to map remote inaccessible areas. Helicopters have been used successfully in mapping surface geology; measuring stratigraphic sections in Guatemala, Libya, the United States, and many other parts of the world, particularly Canada. Thanks to the helicopter, surface geology is once again becoming a popular exploration method. In western Canada alone during the last 3 years, surface mapping has increased 60%; this trend should continue especially in Canada and in many other parts of the world.

Acknowledgment

The cooperation and guidance of G. Keith Williams, geologist with D. Bruce Bullock & Associates, has contributed greatly to this paper. His years of experience in this work have not only improved this field technique but have added measurably to the discussion of this work.

TABLE 2—PERSONNEL OF TYPICAL FIELD PARTIES

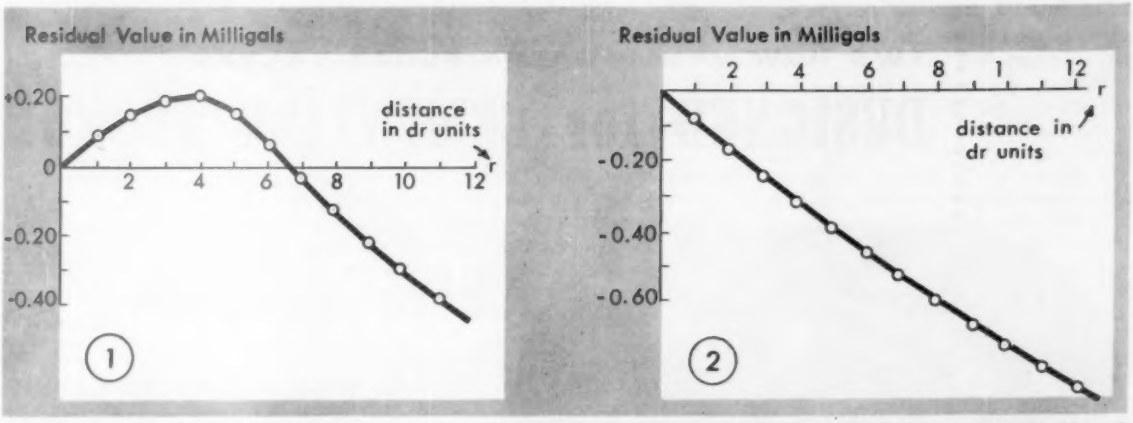
Wright, G.M.*	Douglas, R.J.W.*	Bullock & Assoc.
5 geologists	9 geologists	4 geologists
1 laborer	9 assistants	3 geol. assistants
2 helicopter pilots	3 pilots	1 helicopter pilot
2 helicopter engineers	3 aircraft engineers	1 aircraft mechanic
1 Norseman pilot	1 boatman	1 Norseman pilot
1 Norseman engineer	1 crewman	1 cargoman
1 cook	2 cooks	1 cook
1 cook's helper	1 radio operator	1 cook's helper
1 radio operator		

*Data from Helicopter Operations of the Geological Survey of Canada, Bull. 54, 1959.

TABLE 1—COMPARATIVE COSTS AND TIMES OF HELICOPTER AND CONVENTIONAL SURVEYS

	Bullock		Geological survey of Canada	Hunt	USGS conv.	Walper
	Helicopter	Conv. survey	helicopter	helicopter	survey	helicopter
Time required for survey (days)	12	240	120	7	*315	105
Area mapped (sq. miles)	5,000	5,000	100,000	200	200	100,000
Cost of survey (total)	$10,000	$60,000	$167,500	$7,500	*$25,000	$100,000
Cost per square mile	$2.00	$12.00	$1.68	$3.75	$12.5	$1.00
Cost advantage of helicopter survey	6:1	.....	.....	3.3:1	.....	.....
Effective economic ratio (cost ratio × time ratio)	120:1 in favor of helicopter		.....	150:1	.....	.....

*Estimated.



AN EXAMPLE OF A DENSITY SURPLUS is seen in Fig. 1. On the X-axis the radii that were used are plotted, all with intervals of dr. On the Y-axis are the residual corresponding values. The same residual values are plotted in Fig. 2 without the given surplus density structure. In Fig. 1, it is apparent that the maximum of the residual value belongs to the radius with a value of 4. It is seen that the surroundings should be enlarged so that the deepest residual value can be determined to estimate the depth of lack of density.

New light on isopach residual values

. . . in gravity interpretations

BY W. F. STACKLER

. . . consulting geophysicist in Calgary, Alta. He received his doctor's degree in Berlin in 1925 for a paper interpreting a gravity survey in Africa. From 1926 to 1945 he was with Seismos Co., Hanover, and in charge of a division. In 1945 he became a consultant and in 1952 he moved to Calgary to establish his own practice as a consultant. He is a member of several professional societies.

GRAVITY MAPS which interpreters get from the field crew are usually maps of the Bouguer values. These include all gravitational influences from the deepest basement rocks to the surface beds. The main problem in making gravitational results intelligible for geologists is in finding methods to separate these influences.

Theoretically, gravitational pictures on the surface could result from an infinite number of distributions of density in the subsurface, but physical and geological conditions bring these possibilities to a minimum. Therefore, we have the chance to solve the separation of the gravitational influences depending on the depth.

The approach. There are different ways to proceed, such as the calculation of vertical gradients, of second derivatives, isopach residuals, and others. Each method has advantages and disadvantages. Isopach residuals result to a certain proportion in a subdivision by depth. As opposed to the seismic method, the gravity procedure leading to isopachs gives an approximate picture only in the three-dimensional sense, but for the geologist this represents an improvement in the interpretation.

The possibility of representing isopach residual values depends on the definition of the residual values. Residual values are the remaining parts of the Bouguer values after taking out effects of the regional gravity, thus:

Residual value = Bouguer value minus regional value (1)

The definition of the Bouguer value is well known as the individual gravity value on a certain point corrected for elevation and terrain to a given datum plane. Therefore, the definition of the residual value is related to the regional value. There are two different explanations of the term "regional gravity."

1. Regional gravity is a gravitational trend, and is constant in amplitude and direction over a certain area. Geologically such a trend originates from constant dipping of sediments or a rise in the basement complex. For the gravitational interpretation such effect is only of minor importance because the origin cannot be determined by gravity only. In case a regional trend is of great amplitude it can disturb the local indications in gravity. This easily can be removed by using a rising or dipping datum plane.

2. Regional gravity is the average gravity over certain surroundings. This definition makes the regional gravity a function of the radius fixing the surrounding. The greater such a radius, the more general the regional gravity is defined, and the smaller such a radius, the more local indications of gravity are present.

For our use we prefer to work with the second definition of regional gravity. The usual way (Peters, Elkins, Henderson, Zietz, and others) to average the surroundings is to average 4, 8, 16, or more single gravity values in the periphery or within the fixed surroundings of an individual gravity station. Even though these points have a mathematically given location, we found this averaging is insufficient for regional values when the ultimate objective is to determine depth estimations. Reading only the single values in the surroundings leaves the possibility open for local effects. The total area of the ordered surroundings is integrated and these are taken into consideration for the smallest variation in the contour lines.

After explaining regional gravity, let's go back to equation 1. We intend to use the regional gravity with changing amplitude of the radii r of the surrounding and write Equation 1 in mathematical terms as:

$$\text{Res. Val.} = \Delta g_o'' - 1/r \times 2\pi \int_0^r \Delta g_o'' \, dr \qquad (2a)$$

or with final length of the interval dr

$$\text{Res. Val.} = \Delta g_o'' - 1/r \times 2\pi \sum_0^r \Delta g_o'' \, dr \qquad (2b)$$

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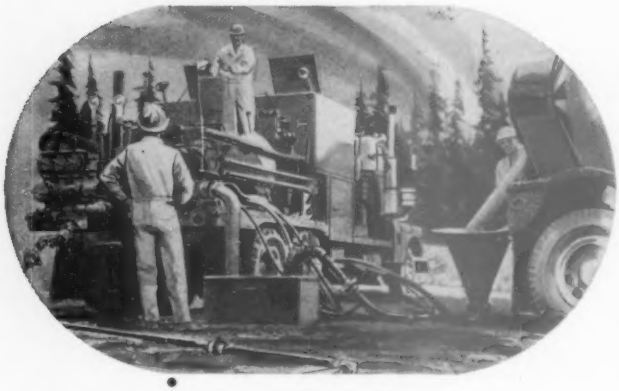

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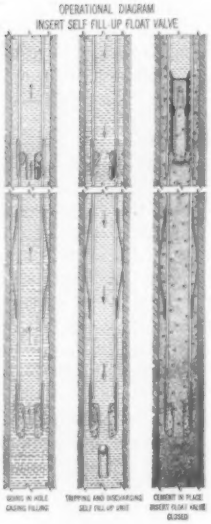
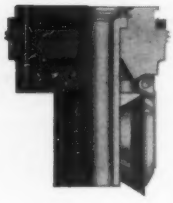
This new Halliburton tool is low in cost, simple in design, and efficient in operation. Installed by a short thread inside the casing coupling and sealed between the casing ends, no length is added to the string. Eliminates two threaded connections for each valve used in the string.

Designed for use in wells where a medium range of differential pressures exist, the assembly consists of a readily-drillable cast aluminum body, flapper valve and spring and two rubber sealing rings. The stout spring helps hold the valve closed during floating-in and after cementing is completed. This tool is excellent for use with a "DV" Multiple Stage Cementer.



INSERT SELF FILL-UP FLOAT VALVE



A combination of the new Insert Float Valve described above and a simple self fill-up assembly incorporating a plastic orifice tube, the Insert Self Fill-Up Valve was designed for use in filling casing in areas where field conditions sometimes interferred with other fill-up devices. See illustration. A pre-selected, special size orifice tube holds the valve open allowing the casing to fill going in the hole. When the casing is within a few joints off bottom, a weighted plastic ball (furnished) is dropped and seats on the valve. After reaching casing point, pressure is increased to break the orifice out of its seat. The plastic flow tube and ball drop through the guide nose to the bottom. The valve then closes and acts to help prevent reverse circulation during and after the cementing operation.

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Now the first term is the Bouguer anomaly of a single individual station. The second term is the regional gravity for a variation of the radii r of the surroundings. This means 2b is not a single equation but a sum of equations with increasing radii. In surroundings with small radii, gravity changes coming from density contrasts close to the surface are overwhelming. By greater radii deeper areas of the sediments and later of the basement gain in influence and the local effects disappear more and more.

Accuracy of residual values. It is suitable to mention some remarks on the accuracy of the residual values. Equation 2 shows that the Bouguer value $\Delta g_o''$ is an additional factor for the equation of the residual value. Therefore, the accuracy of the residual value cannot be better than that of the observed and corrected Bouguer value and it is not logical to determine methods to make the second part on the right side more accurate. Any of the normal methods as mentioned before will be sufficient. Determining residual values to derive isopach residual values requires more accuracy. For these values the single-station value will disappear and the isopach residual value will have the accuracy of the averaged gravity.

To make the calculations easier to perform always use constant intervals dr between the radii r_1, r_2, r_3 . . . r_n. Thus

$$r_2 = r_1 + dr;\ r_3 = r_2 + dr \text{ etc.}$$

It is illogical to establish the distances dr between the radii smaller than the original station spacing permits. The distances dr are in connection with the depth intervals and it will be seen that they give an average error of any possible depth estimation.

As said before, the indications of gravitational influences on the residual values are related to the depths of their origin. Density contrasts close to the surface are overwhelmingly indicated by residual values with small radii of the surroundings. The reverse of this also applies.

Fig. 1 is an example of a density surplus at a certain depth. On the x-axis are plotted the radii used, all with intervals of dr. On the y-axis the corresponding residual values are shown. Fig. 2 shows the same residual values but without the given surplus density structure. Fig. 1 shows that the maximum of the residual value belongs to residual value with the radius 4. Additional Figs. 1 and 2 show that in the deeper zones one must expect a gravitational minimum. The radius 12 of Fig. 1 has not yet reached minimum and the surroundings should be enlarged to obtain the deepest residual value and hence estimate the depth of the lack of density in the deeper layers.

At this point all the suggestions are correct without any presuppositions. Our findings will never be unequivocal without additional geological data. We are only able to give the depth of the gravity center of a density contrast. Results on the average of the form of a given density contrast are only possible if the amplitude of the contrast is known. A density contrast of 0.1 can have the same gravity feature as a density contrast of 1.0, if they have the same gravity center and if their forms are similar but 10 times larger for the contrast 0.1.

Suppositions Are Necessary for Body Shapes

To do estimations a presupposition is necessary at this point. For the three-dimensional type of structural bodies it is presumed that such bodies shall have one gravity center and that this center belongs to a structure with spherical shape or is the sum of gravity centers with spherical-type structures. The last condition includes any three-dimensional type of geological possibilities. For the two-dimensional type of structural bodies (anticlines etc.) the presumptions are logically similar. They shall have a gravity center of a structure with a cylindrical shape or shall be the sum of centers of cylindrical structures in parallel directions. The last condition again includes any two-dimensional geological possibility.

For these two mathematical bodies (sphere and cylinder) the Bouguer pictures are calculated and the residual values with smallest radii intervals belonging to it. By doing so is found the correlation between the radius of the residual value with the maximum effect and the depth of the gravity center of the body. As corresponding values of a cylinder and of a sphere for any depth it is found that,

$$\text{Depth of the structure} = D_{Str.} = r_{max} \times \text{tang. nat. } 50^\circ \qquad (3)$$

This value is empirical. This can be proved theoretically, too. Maxima and minima considerations on the mathematical equation d (Res. Val.)/d ($D_{Str.}$) derived from Equation 2a would be proof and give the correct depth. Thus the empirical or graphical value is satisfactory. In nature normally there are no mathematical conditions and hence only an approach is possible through the use of mathematical bodies.

Methods for Depth Estimations

There are different ways to make depth estimations. For example, one can use a width at half of maximum intensity and apply the tangent for depth estimations. These methods in their approach use only single values of the isogams or of the gravity feature or cross-section profiles to make estimations. Therefore, they cannot have the same accuracy as the method using the total integrated gravity feature. A second reason for not using these methods is that these ways will not show the great inaccuracy of gravitational depth estimations generally. By plotting our method as shown in Fig. 1, we can always see the existing inaccuracy of the estimation even though our presumptions are correct.

So far we have only spoken of residual values and not of isopach residual values. The change from one to the other is very easy. If we write the Equation 2b in full for all radii:

$$\text{Res. Val.}_1 = \Delta g_o'' - 1/r_1 \times 2\pi \times \sum_0^{r_1} \Delta g_o'' \, dr$$

$$\text{Res. Val.}_2 = \Delta g_o'' - 1/r_2 \times 2\pi \sum_0^{r_2} \Delta g_o'' \, dr \qquad (4)$$

Thus:

$$\text{Res. Val.}_n = \Delta g_o'' - 1/r_n \times 2\pi \sum_0^{r_n} \Delta g_o'' \, dr$$

r_1 to r_n are again the radii of the surroundings with constant intervals. By means of subtraction it is easy to calculate the isopach residual values:

$$\text{Isopach Res. Val.}_{o,1} = \Delta g_o'' - 1/r_1 \times 2\pi \sum_0^{r_1} \Delta g_o'' \, dr$$

$$\text{Isopach Res. Val.}_{1,2} = 1/r_1 \times 2\pi \sum_0^{r_1} \Delta g_o'' \, dr - 1/r_2 \times 2\pi \sum_0^{r_2} \Delta g_o'' \, dr \qquad (5$$

Thus:

$$\text{Isopach Res. Val.}_{n-1,n} = 1/r_{n-1} \times 2\pi \sum_0^{r_{n-1}} \Delta g_o'' \, dr - 1/r_n \, 2\pi \sum_0^{r_n} \Delta g_o'' \, dr$$

The multiplication with tan. nat. 50° of each equation, corresponding to Equation 3, gives the depth of each isopach zone. This step is readily performed but the progress received is

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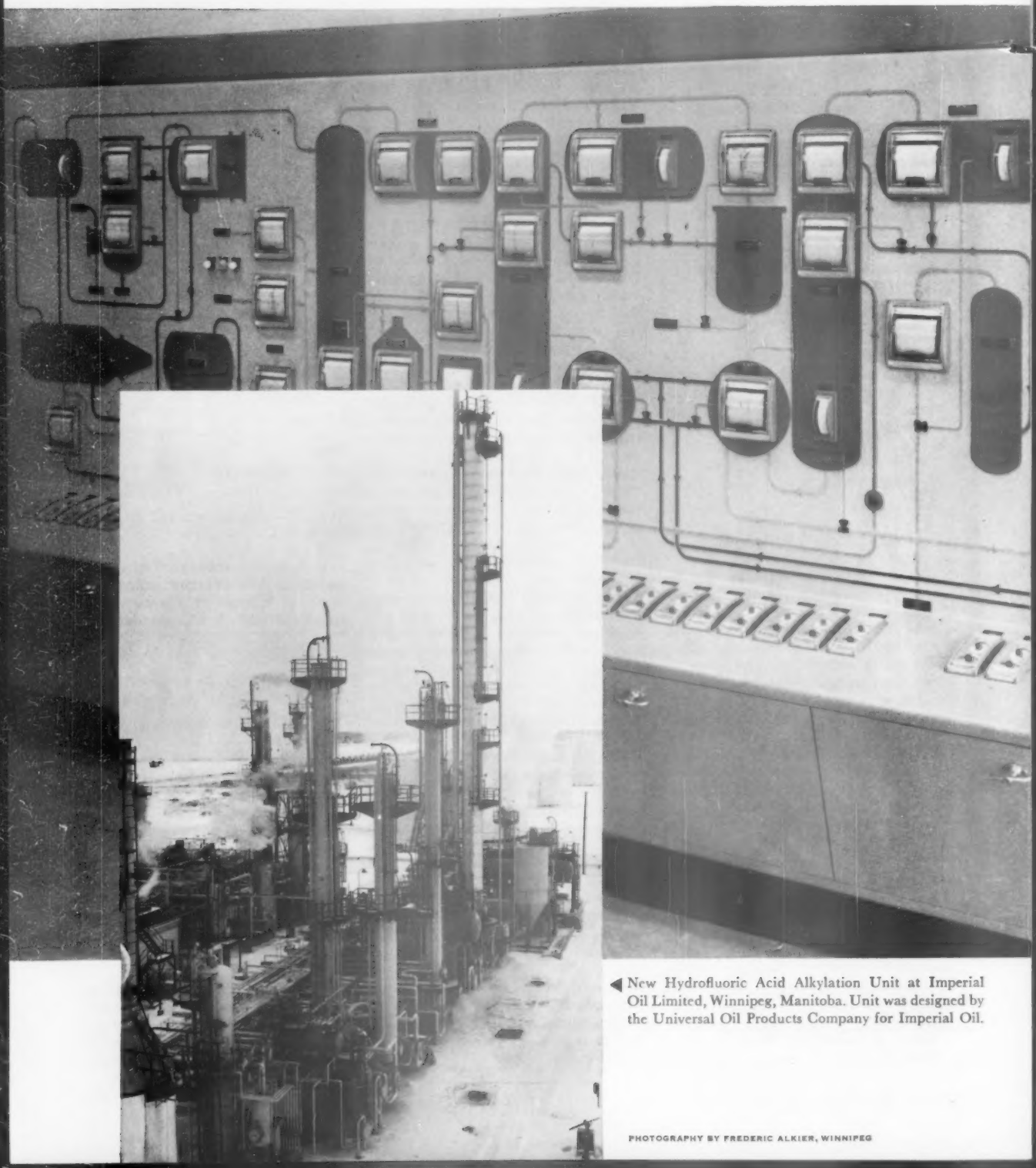
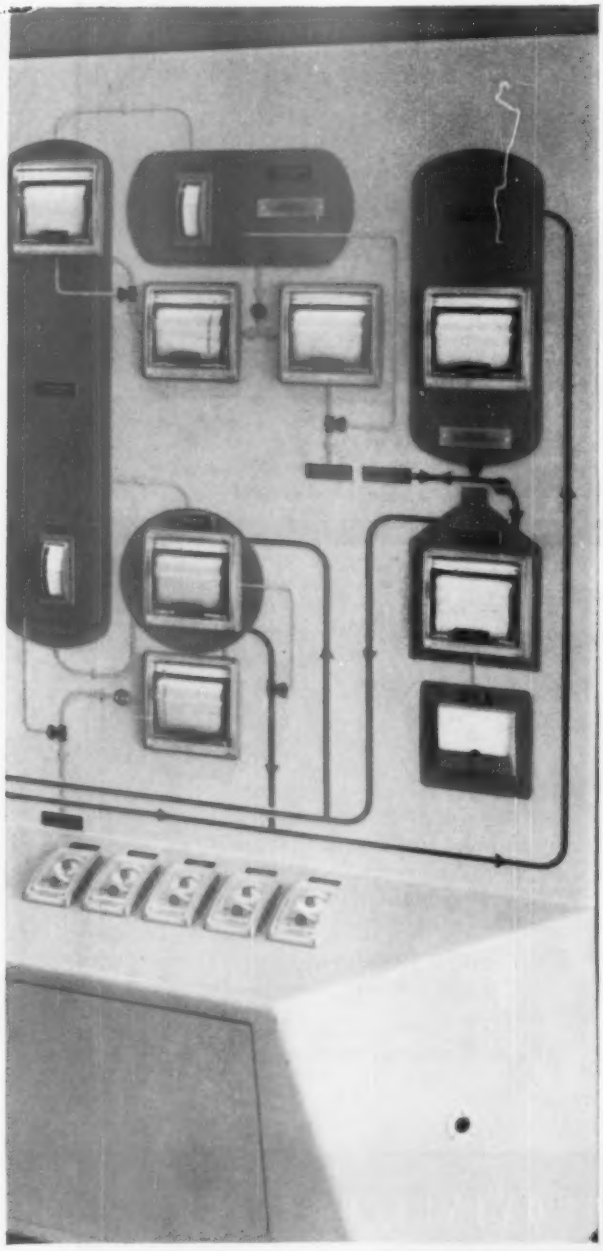
They wanted a low - they chose Foxboro



◀ New Hydrofluoric Acid Alkylation Unit at Imperial Oil Limited, Winnipeg, Manitoba. Unit was designed by the Universal Oil Products Company for Imperial Oil.

PHOTOGRAPHY BY FREDERIC ALKIER, WINNIPEG

maintenance electronic system... Electronic Consotrol instrumentation



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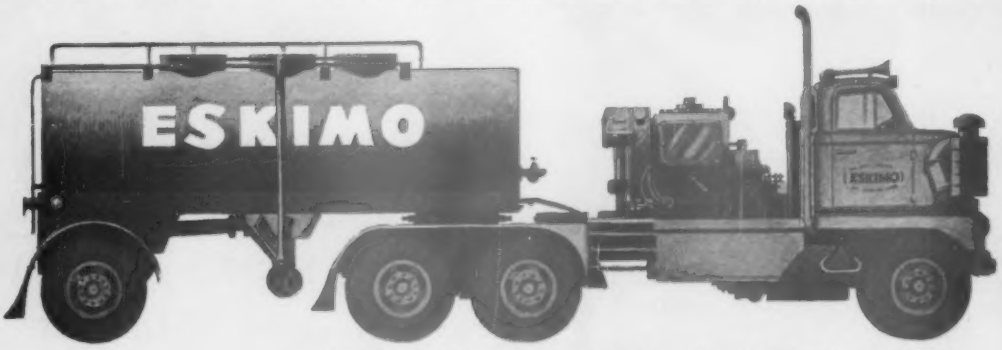

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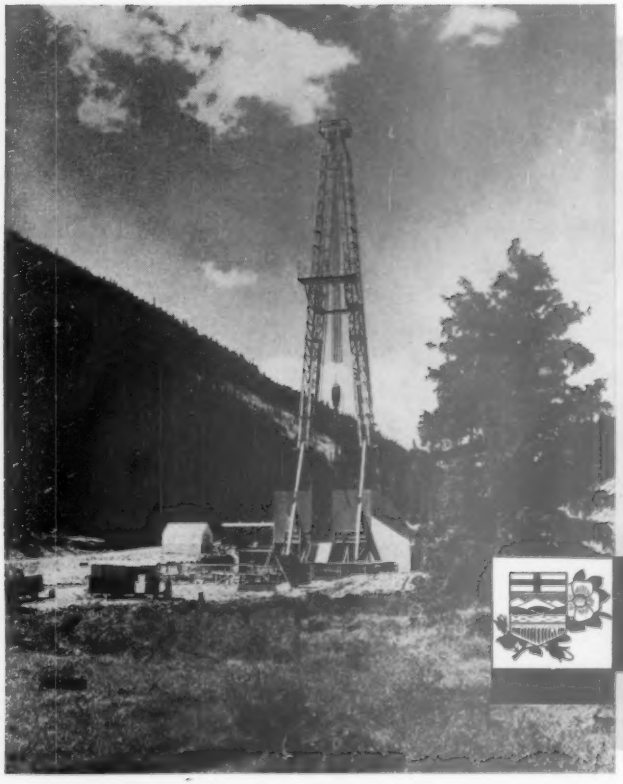

The Province of Alberta has 220,000 square miles underlayed by sedimentary deposits. It will require one wildcat well for every 10 square miles to adequately explore this basin.

To the end of 1959 approximately ¼ of these wildcats have been drilled.

Alberta is still an oil frontier.

PROVINCE OF ALBERTA

DEPARTMENT OF MINES AND MINERALS
H. H. Sommerville, Deputy Minister
Hon. E. C. Manning, Minister

important. It is not possible to separate gravitation effects of structures from the other indications, but the gravitational effects have been subdivided in parts with continuous sequence. Each part gives the gravitational effect of the layers in their own zone but also additional distance influencing forces from upper and lower zones with decreasing tendencies. Each gravitational effect has its maximum in its own zone and results in the opportunity to estimate its depth.

Caution required in the method. First, caution must be used with this method of isopach values on residual values calculated with short-cut methods (single-point readings). These methods do not have sufficient accuracy to be used as isopach values. Secondly, it is not logical to make the slices of the isopach zones smaller than the actual station spacing permits. It will not increase the accuracy of depth estimation. If the station spacing is 1 mile apart it cannot be expected to obtain a better depth estimation than ± 1 mile in depth, even though the single values are of very high accuracy.

It is important to mention the accuracy of the isopach residual values. As seen already, the accuracy of the residual values cannot be better than the average error of the single Bouguer value, because this value is an additional factor of Equation 2. Therefore, the residual values have a limitation in accuracy. The isopach residual values are different. Except for the first value in Equation 5, single Bouguer values are not involved in the equations any more. They are difference values of the average gravity in a certain area. Their accuracy is a function of the station spacing in this area according to the theory of probabilities.

Spacing is critical. Station spacing means for the two-dimensional type of surveys, the station distance from station to station. For the three-dimensional type of surveys, station spacing is the spacing all around. A survey of profiles with ¼-mile station spacing, but 1 mile apart, has correspondingly only an accuracy of 1-mile spacing survey for the three-dimensional type of isopach residuals. Therefore, it is always desirable to make depth estimations using the two-dimensional type of profiling survey. In such cases, we receive very good estimations with fewer stations. Those profiles must run at right angle to the structure in question as much as possible. Parallel to an anticlinal structure, the isopach residual values will show no effect at all.

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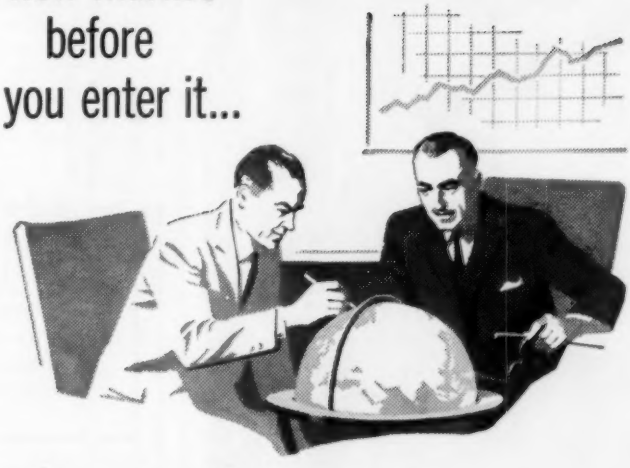

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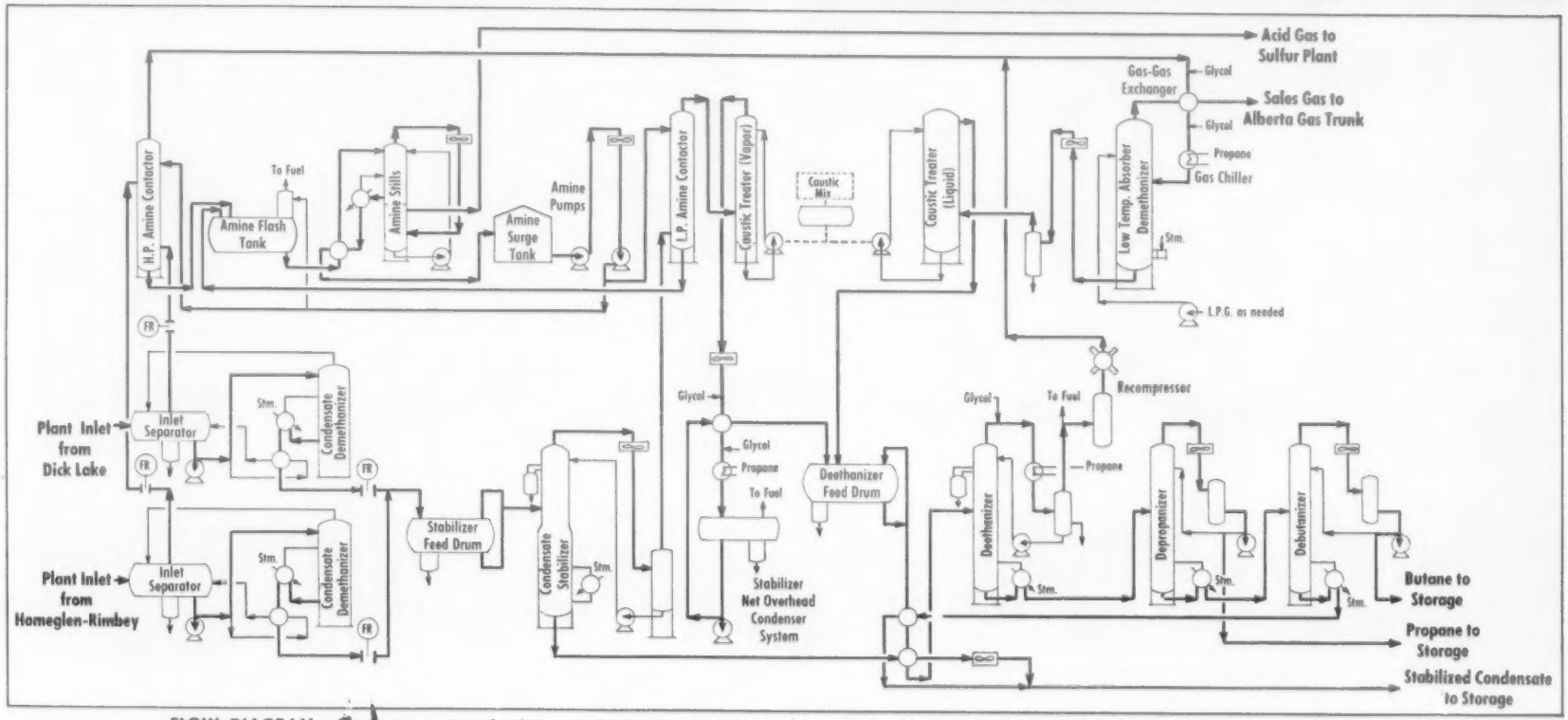


FLOW DIAGRAM of gas-processing facilities and some construction views of the Rimbey gas plant being built by British American et al.

Canadian gas-processing plant

will be joint effort of 26 operators

GAS-PROCESSING facilities are being built by British American Oil Co., Ltd., jointly with 25 other companies, northeast of the Central Alberta town of Rimbey, between Homeglen-Rimbey and Dick Lake fields. Completion is expected sometime this fall.

The plant will have design capacity of 326 M.M.c.f.d. of raw gas that will be gathered separately from the Leduc D-3 reservoir of each field and delivered by each field operator to the gas-processing plant.

Residue gas will be delivered to Alberta Gas Trunk Line Co., Ltd., for the account of Trans-Canada Pipe Lines, Ltd., and Alberta and Southern Gas Co., Ltd.

Design features. Separate inlet facilities will receive and measure gas and liquid from each field. Periodic analysis of the raw gases and liquids will allow proper allocation of the sales gas and plant products to the fields from which they are produced. Inlet venting and a dump liquid separator will be provided for emergency handling of the inlet-gas and liquid streams.

Monoethanolamine gas-treating facilities are designed to produce residue gas having not more than 0.25 grains of hydrogen sulfide (H_2S) per 100 cu. ft. Three high-pressure amine contactors will remove acid gases from the main gas stream and a low-pressure contactor will remove them from the condensate stabilizer overhead.

Hydrocarbon-dew point control and liquid extraction from the gas will be achieved by propane refrigeration of the gas stream using centrifugal compressors. The gas-handling portion consists of dual units for flexibility of operation.

Water dew point will be reduced and hydrate formation prevented by injecting glycol solution into the gas stream ahead of the exchangers and chillers. The glycol is removed and concentrated for recirculation.

Raw condensate from the inlet separators is to be fractionated to remove H_2S and other light ends and a butane-free product produced as bottoms from the condensate stabilizer.

Condensate stabilizer overhead and liquids from the low-temperature separator will be caustic treated to remove residual H_2S and mercaptans and fractionated to produce salable propane, butane, and pentanes plus.

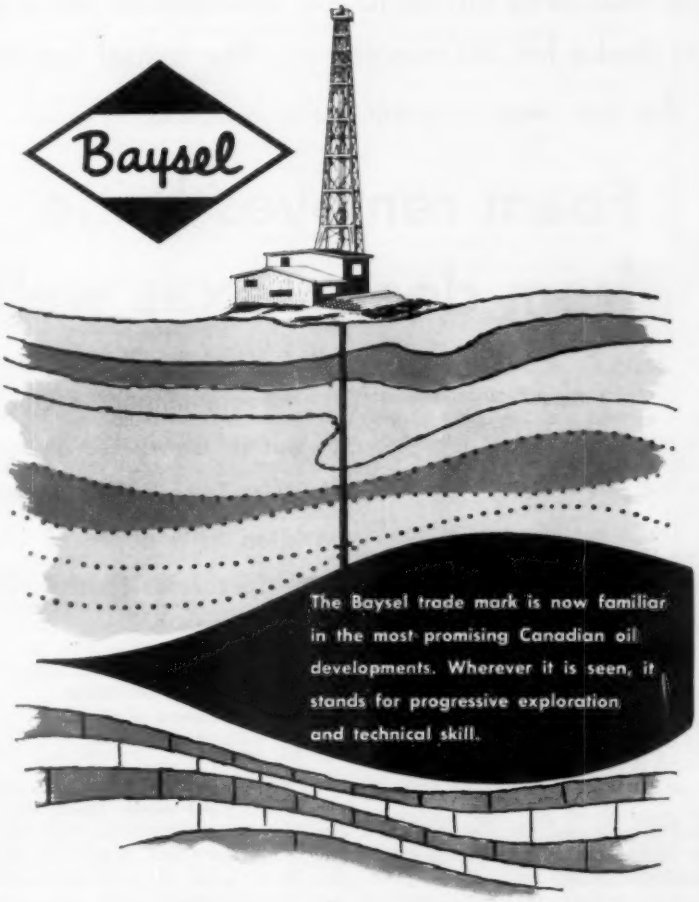
Elemental sulfur is to be produced from the acid-gas stream by the modified Claus process. The liquid sulfur will be produced into gaging pits before being transferred to liquid loading or to the solid-sulfur storage vat.

Separate storage tanks and product shipping facilities are being installed for propane, butane, and condensate.

DESIGN RECOVERY

Product—	Recov. eff.	Daily prod., Imp. gal.
Propane	25	68,000
Butane	53	98,000
Pentanes plus	93	325,000
Sulfur	90	*233

Water for boiler feed, domestic, and plant usage will be obtained from water wells. All coolers in the plant are cooled by air. Water treating, steam generation, electric-power-generation facilities, air and fuel-gas systems are integral parts of the plant design.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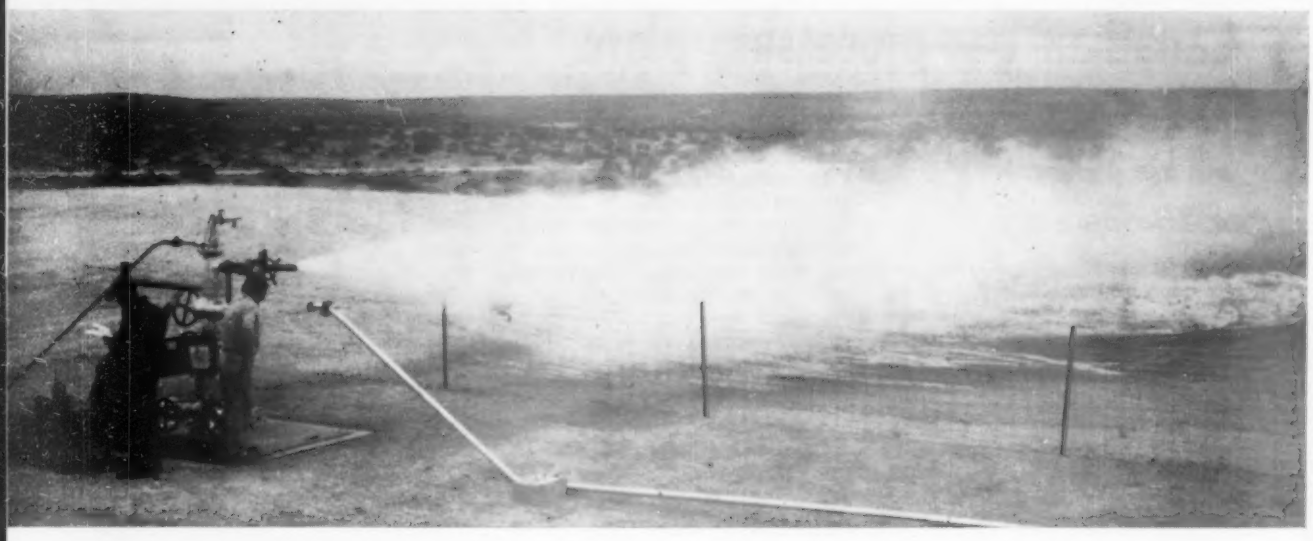

"The well was blown to the atmosphere through a five-eighths-inch choke for 30 minutes . . . The actual liquid-removal part of the test was a spectacular success."

Foam removes brine from deep Texas wells

• Foam method of liquid removal from gas wells was put to severe test in two high-temperature wells in West Texas. Ellenburger lime production was stimulated at a depth of 15,000 ft., where bottom-hole temperatures reached 208° F.

BY J. L. EAKIN, A. D. HOPKINS, AND H. N. DUNNING
U. S. Bureau of Mines, Bartlesville, Okla.

SINCE the recent announcement[1] of a new method for removing brines from gas wells, extensive laboratory and field tests have established the value and general applicability of the method.[2]

Two West Texas Ellenburger wells. The first well treated was completed in October 1954, and had an initial open-flow potential of 7 M.M.c.f.d. It was classified during recent months as a high-pressure, low-volume well in which liquids entered the well bore faster than the produced gas could carry them to the surface. Normally, the well is produced for 3 to 7 days and shut in for 3 weeks to keep it alive.

Gas is produced through perforations in the 5½-in. casing in the interval from 14,710 to 15,030 ft. The producing string is 2⅞-in.-o.d. tubing set on a packer at 14,681 ft. Gas production averages from 5 to 7 M.M.c.f. per month. About 4 bbl. of water and 0.4 bbl. of 51.8°-API-gravity condensate are produced with each million cubic feet of gas.

In preparing for the test, this well was shut in for 3 weeks, during which time the tubing pressure reached 2,681 psig. Laboratory tests showed that Triton QS-15 is one of a few agents that will foam at temperatures above 200° F. and in mixtures of brine and light hydrocarbons. Therefore, 65 gal. of Triton QS-15, diluted with 4 bbl. of water, was pumped into the wellhead and washed down the tubing with 22 bbl. of water. After a shut-in period of 38 hours to permit mixing of the liquids, the well gradually was opened to the atmosphere through a ⅝-in. choke. During a 30-minute period, the well produced an estimated 8 bbl. of liquid. While the well was producing overnight to the pipeline, an additional 7 bbl. of water was produced as foam. The well continued to produce liquids at a good rate during the next 3 days of production, but the influx of liquid probably exceeded the rate of removal. Although no permanent improvement of the well was accomplished, the test showed that the foaming agent would permit the production of brine as foam at temper-

atures up to 208° F. in the presence of light hydrocarbons.

The second well treated was completed during 1955 and had a calculated open-flow potential of 52 M.M.c.f.d. The shut-in tubing pressure was 4,504 psia. The well was completed with 5½-in. casing to the top of the Ellenburger lime at a depth of 14,000 ft. It was equipped with 2⅞-in. o.d. tubing to 14,780 ft. On the basis of the original back-pressure test, the well could be produced efficiently to the pipeline at rates as high as 20 M.M.c.f.d.

The performance of the well was checked periodically by comparing data from the original back-pressure test with results from subsequent "spot" deliverability tests. During July 1958, the well was recompleted; a tubing fish was left in the open-hole section from 14,120 ft. to bottom at 14,780 ft. The well was retubed with a string of 2⅞-in.-o.d. tubing to a depth of 14,120 ft. and set on a packer in 5½-in. casing at a depth of 13,810 ft. This completion left 660 ft. of open hole in which liquids and debris could accumulate.

An extended open-flow test to the pipeline in September 1959 showed that liquids could be moved from the open-hole sump by increasing the rate of gas production. At the end of 6 hours, with the well open to the pipeline, gas was produced at a rate of 11 M.M.c.f.d. with a tubing pressure of 1,321 psia. At the end of 29 hours, the rate of flow had increased to 15 M.M.c.f.d. at an increased tubing pressure of 1,570 psia. The normal liquid production rates are 1.4 bbl. of water and 1 bbl. of 53.3°-API-gravity condensate per M.M.c.f. of gas. Because the well stabilized immediately, flow tests over extended periods were not required. A deliverability test in October 1959, a month after the open-flow test, showed that the well was producing gas at the rate of 6.5 M.M.c.f.d. at a wellhead pressure of 3,554 psia. This rate was about 40% of the capacity indicated by the original back-pressure curve.

Ideal for foam test. The well was selected for foam test after it became evident that liquids could be moved from the sump at increased flow rates. Early in December 1959 the well was shut in and treated with 50 gal. of Triton QS-15 mixed in 100 gal. of water pumped through the tubing against a pressure of 4,000 psi. Three barrels of alcohol and, after 4 hours, 11 bbl. of water were pumped into the tubing to wash the foaming agent down the well. After a mixing period of 24 hours, the well was blown to the atmosphere through a ⅝-in. choke for 30 minutes. During this period, about 30 bbl. of water and light condensate was blown from the well as a misty foam. The actual liquid-removal part of the test was a spectacular success.

A deliverability test of the well showed some improvement in flow capacity a few days following the treatment. The residual foaming agent, mixed with liquids remaining in the sump, assisted in removing some liquids gradually in addition to the volume lifted at normal rates of production.

A deliverability test in January 1960, 1 month after the treatment, showed that the well produced gas at the considerably improved rate of 12 M.M.c.f.d. with an increased tubing pressure of 3,300 psia. Therefore, as a result of the treatment, this well had improved about 85% over its previous efficiency and was flowing at 80% of the original capacity.

These favorable results with the foam method were obtained despite severe handicaps of high temperatures, great depths, and the presence of hydrocarbon condensates. Furthermore, because the wells were complete with packers, it was impossible to "rock" the well to obtain efficient mixing of the well fluids and the foaming agent.

The lasting improvement in the performance of the second well is attributed to the cleaning of the sand face and the formation immediately adjacent to the well bore and the removal of residual liquids from the well bore by the detergent that was used as a foaming agent.

In conclusion, the foam method is effective in removing brine and condensate from deep, high-temperature wells. Substantially increased natural-gas production resulted from removing liquids from wells with a recently tested foaming agent. Laboratory studies of foaming at elevated temperatures and extensive engineering evaluations of well characteristics led to the successful removal of enough brine and condensate to increase the daily productive capacity of gas from one West Texas well by 5.5 M.M.c.f.

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Acknowledgment

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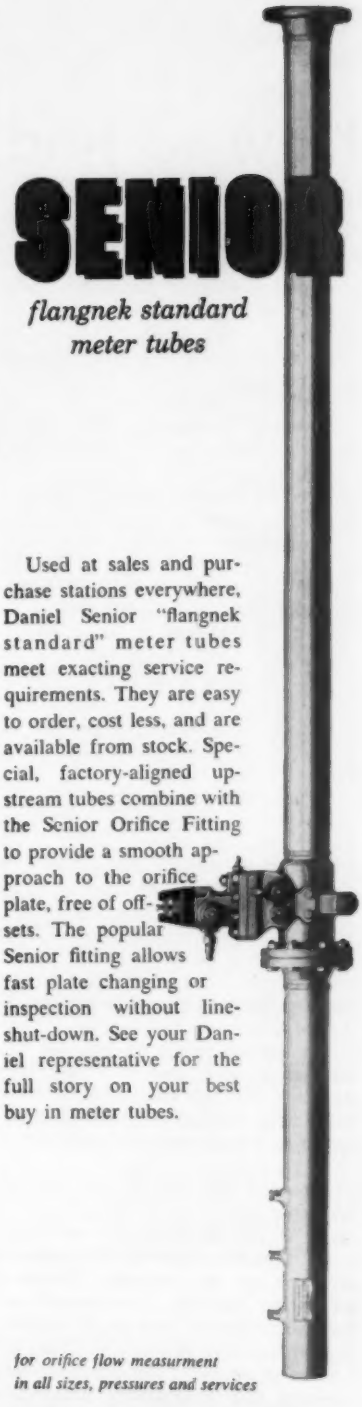

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How to find your power requirements

BY JOSEPH ZABA

ONLY A SMALL portion of the power required in a pumping installation is used in the useful work of lifting the well fluid.. The rest is needed for overcoming internal losses of the system.

Hydraulic horsepower. The power needed to lift the well fluids is simply the power necessary to lift a given number of barrels over a given distance in a fixed period of time. This power may be expressed as:

$$HP_H = \frac{Q \times W \times L}{33{,}000 \times 24 \times 60}$$

$$= \frac{Q \times W \times L}{33{,}000 \times 1{,}440} \quad (1)$$

Where:
HP_H = hydraulic horsepower
Q = barrels of fluid to be lifted in 24 hours
W = weight of 1 bbl. of fluid, lb.
L = effective lift, ft.

Power is rate of doing work. If the same volume, Q, is to be lifted in a shorter period of time then adjustment must be made in the equation to the 24-hour rate. For instance, if the power needed to lift 48 bbl. per day were calculated, and if it was then decided to lift this volume in 12 hours, the power requirements would correspond to a rate of 96 bbl. per day.

Effective lift. This is the distance from the surface to the pumping fluid level. It can be measured or calculated. Measurements can be made by any one of the available fluid-level measuring devices. Calculations can be made from the data on the producing bottom-hole pressure or from information on well's static bottom-hole pressure and productivity index factor.[1] The relation between producing bottom-hole pressure and the corresponding fluid level is:

$$P_{PR} = H \times (1/144) \times 62.4 \times S \quad (2)$$

or

$$H = \frac{2.31 \times P_{PR}}{S} \quad (3)$$

Where:
H = height of fluid in well, ft.
P_{PR} = producing bottom-hole pressure, psi.
S = specific gravity of the fluid
62.4 = weight of 1 cu. ft. of water at 60° F., lb.

The effective lift equals total depth of well less the height of fluid in the well:

$$L = D - H = D - \frac{2.31 \times P_{PR}}{S} \quad (4)$$

Where:
L = effective lift, ft.
D = total depth of well, ft.

The rate of flow of a well is, in general, proportional to the difference in static and producing bottom-hole pressures:

$$Q = C (P_{ST} - P_{PR}) \quad (5)$$

Where:
Q = production, bbl. per day
C = productivity index factor, bbl. per day per psi. pressure drop at the producing sand
P_{ST} = static bottom-hole pressure, psi.
P_{PR} = producing bottom-hole pressure, psi.

Solving for P_{PR} and substituting in Equation 4 the expression for effective lift may be written:

$$L = D - (2.31/S) [P_{ST} - (Q/C)] \quad (6)$$

In finding hydraulic horsepower, some designers assume that during pumping operations the fluid is located at the pump. In such cases the effective lift equals the setting depth of the pump.

Polished-rod horsepower. This is the power needed at the polished rod to lift the fluid and to overcome the surface losses. This power may be determined by (1) calculating the hydraulic horsepower and assuming the lift efficiency, (2) use of empirical formulas, or (3) calculation from dynamometer card, if one is available.

Lift efficiency. The ratio of hydraulic horsepower to polished-rod horsepower is the lift efficiency. Because of many factors which cause loss of power between polished rod and pump, lift efficiencies vary widely from well to well and in any given well as conditions change during its pumping life.

One of the factors causing the loss in power is friction. This can occur at several points in the system. There is friction between rods and tubing, aggravated by crooked holes, friction between the plunger and the barrel, and friction at the stuffing box[2] to mention a few. These depend on well and fluid characteristics, and on the state of repair of the subsurface equipment.

Other losses include those resulting from slippage of fluid past the plunger and from power needed to handle vibrational, shock, and impulse loads. These losses depend on characteristics of the pumping cycle, on load and fluid characteristics, on type of equipment used, and on the state of repair of such equipment.

All of these factors affect the power requirements at the polished rod. Since the hydraulic horsepower is a function of the amount fluid lifted and of the effective life the relation between pumping depth and the effective lift will affect the lifting efficiency. For a given pumping depth, with given fluid characteristics, the lifting efficiency will decrease with the effective lift since, with constant pumping depth, the friction affecting the polished-rod horsepower remains constant while the hydraulic horsepower decreases with decreasing lift.

Data have been presented on a large number of pumping installations which permitted calculation of lifting efficiencies.[3] One of the studies of these data, presenting the efficiency as a function of the well depth, shows the efficiency increasing to a peak of around 55% at the depth of around 3,000 ft. and slowly decreasing below this depth.[4] Other tests made at different times seem to confirm the figure of 50% lift efficiency as a reasonable estimate for calculation of polished-rod horsepower from the hydraulic horsepower.

If both pump dynagraph and polished-rod dynamometer cards are available, lift efficiency can be accurately determined. Areas of dynagraph and dynamometer cards represent respectively work performed at the pump and energy delivered at the

polished rod. Ratio of the areas of the two cards represents the lift efficiency.

Empirical formulas. Certain empirical formulas have been developed for finding of polished-rod horsepower. One of them furnishes means for getting approximate power needed to overcome friction.[5] The formula is as follows:

$$HP_F = \frac{1/8\, W_r \times 2S \times N}{33{,}000} \quad (7)$$

Where:

HP_F = horsepower to overcome subsurface friction
W_r = weight of rods, lb.
S = length of polished-rod stroke, ft.
N = s.p.m.

Power calculated by use of this formula added to hydraulic horsepower from Equation 1 would represent approximate polished-rod horsepower needed, assuming that losses other than friction are negligible.

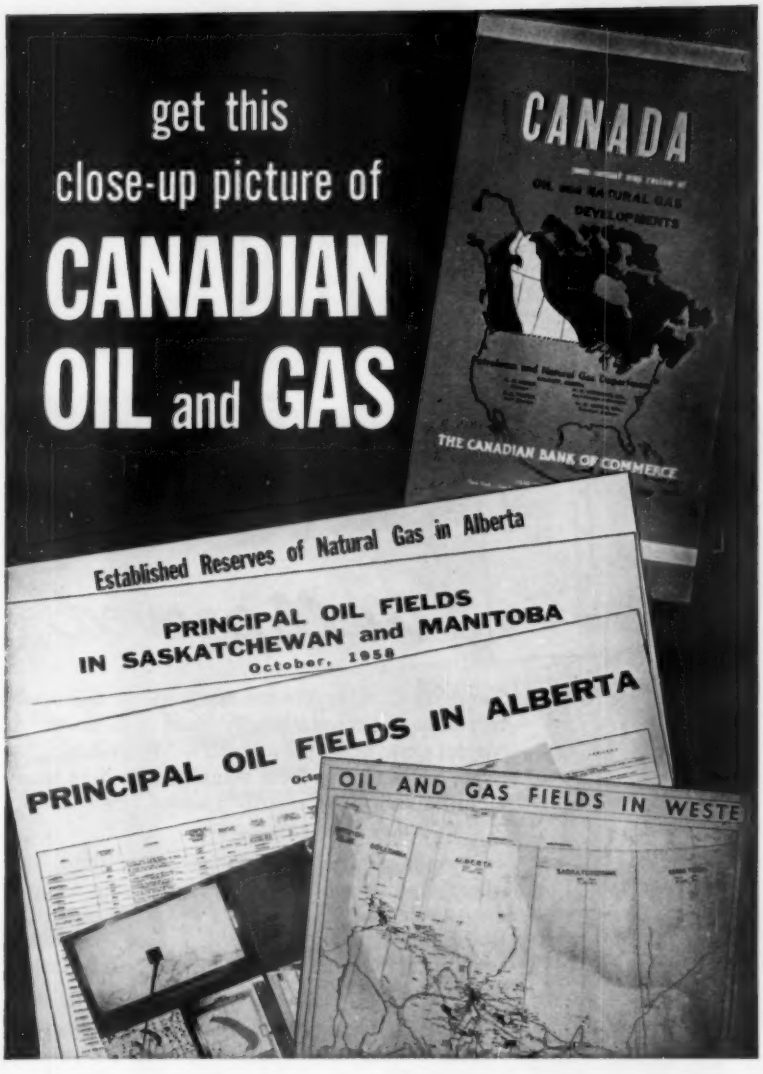
Another formula bases calculation of polished-rod horsepower on approximate relationship between the area of a dynamometer card and the loads involved.[6] The only assumption needed when using this formula is the validity of the relationship which has evolved from a study of a large number of dynamometer cards. In effect, under the above assumption, the use of this formula is equivalent to calculation of the polished-rod horsepower directly from dynamometer card.

The relationship between the loads and the area of the card has been found to be different for slow and for fast speeds of pumping. For speeds of 10 s.p.m. or less, the card area is approximately the product of the difference between the peak load and the dead load times the length of stroke. For speeds above 10 s.p.m. a factor has to be introduced for forces necessary for acceleration and the formula evolved from the above relation may be written as follows:

$$HP_{PR} = \frac{W_f \times S \times N\left(1 + \frac{b^2 S/2}{g}\right)}{396{,}000} \quad (8)$$

Where:

HP_{PR} = horsepower at polished rod
W_f = static fluid load = plunger area × feet of lift × hydrostatic pressure per foot of fluid
S = length of polished-rod stroke, in.
N = s.p.m.
b = angular velocity in radions per second



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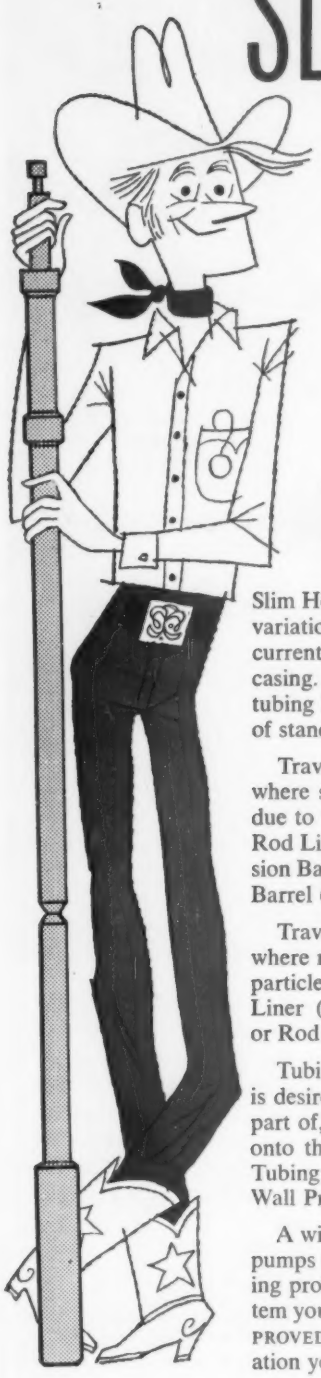

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Power from dynamometer cards. Area of a dynamometer card represents, in foot-pounds, the energy delivered to the polished rod. The formula for calculating the polished-rod horsepower from a dynamometer card is:

$$HP_{PR} = \frac{A \times S \times N \times C}{L \times 12 \times 33{,}000} \quad (9)$$

Where:

HP_{PR} = polished-rod horsepower
A = area of card, sq. in.
S = polished-rod stroke, in.
N = s.p.m.
C = calibration constant of dynamometer, lb. per inch of card height
L = length of card, in.

Surface efficiency. Power requirements at the prime mover depend on the efficiency of the equipment between the prime mover and the polished rod. In modern pumping installations, operating in a good state of repair, this efficiency is rather high, probably over 80%.

Over-all power requirements. Polished-rod horsepower may be calculated by one of the formulas given and, by assuming a surface efficiency, prime-mover power requirements may be determined. Or these requirements may be calculated directly from hydraulic horsepower assuming an over-all efficiency of the system from the pump to the prime mover. If the lift efficiency is assumed to be 50% and the surface efficiency 80% then the over-all efficiency of the system would be 40%.

In using these efficiencies consideration must be given to cases in which heavy surface equipment is used to handle relatively light well loads. With a drastically underloaded pumping unit, the prime-mover power needed to overcome internal losses may be higher than indicated by the rule-of-thumb percentages mentioned earlier. This matter and the question of fitting different types of prime movers to the calculated power requirements will be included in a later installment dealing with prime-mover selection.

The formulas given for calculation of power requirements are only approximations. Actual needs may be higher so safety factors are used when selecting prime movers. They may also be lower because of the lifting help furnished by gas. Study of a number of pumping wells showed that efficiency of using the lifting power

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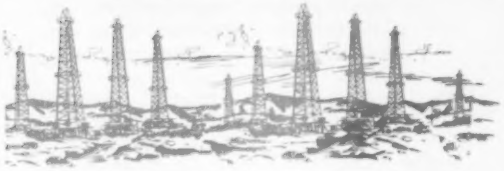

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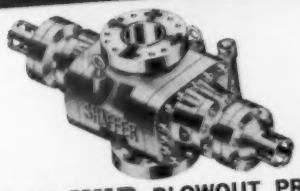
are ideal for the great majority of general drilling applications. Both types feature:

"Swinging Side-Opening" Doors for quick, convenient ram changes without dismantling the hook-up or losing operating fluid... Positive "In-Line" Ram-and-Piston design that eliminates yokes, levers and other complicated assemblies... and many other important advancements!

Type B has *non-rising* locking shafts for those preferring maximum compactness... Type E has *rising* locking shafts for those preferring quick indication of ram position. Otherwise they are the same in their many operating advantages!



SHAFFER TYPE XHP BLOWOUT PREVENTERS

are ideal where *extra high* well pressures are a problem. The 7-1/16" bore size safely handles *working* pressures to 15,000 PSI ... the 9" and 11" bore sizes safely handle *working* pressures to 10,000 PSI. All three feature...

"Swinging End-Opening" Doors for quick, easy ram changes without dismantling the hook-up or losing operating fluid... Positive "In-Line" Ram-and-Piston design, with no levers, yokes or other complicated operating connections... and many other Shaffer field-proven advantages!

If you have extremely high well pressures to control, Shaffer Type XHP is the blowout preventer you'll want!

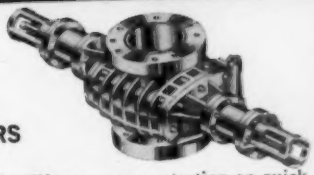
SHAFFER ROTATING BLOWOUT PREVENTERS and STRIPPERS

combine a Blowout Preventer and a Stripper in one trouble-free unit that maintains continuous pressure protection *automatically* as long as the drill string is in the hole.

There's nothing to forget—or remember—with this unit because it is always packed off around the drill string, whether the string is rotating, is being raised or lowered, or is stationary. Moreover, the self-adjusting Stripper Rubber expands and contracts automatically to fit the varying diameters of drill pipe, couplings and tool joints—as well as the varying shapes of square, hexagon and octagon kellys!

You can use this unit for regular drilling; for drilling with air or gas; for drilling with reverse circulation; and for drilling under pressure... wide-range versatility to fit *your* drilling requirements!

SHAFFER TYPE LWS BLOWOUT PREVENTERS



are particularly designed to simplify pressure protection on quick in-and-out production and re-work jobs where light weight and minimum rig-up time are vital factors.

In the 7-1/16" Bore Size, Type LWS Preventers weigh only 780 lbs. for easy transportation and handling... Operation can be either by a conventional hydraulic system or by a portable hand-pump where simplest possible installation is desired.

These features, plus all the other Shaffer advancements (Swinging *End*-Opening Doors, Positive "In-Line" Ram-and-Piston design, etc.) make the Type LWS ideal for modern repair and re-work jobs!

REMEMBER—Shaffer's line of pressure control equipment also includes a complete range of *Mechanically*-Operated Blowout Preventers... plus Shaffer Landing, Casing and Tubing Heads... Shaffer Flow Beans... Shaffer Kelly Cocks... Shaffer Plug Valves ... and other advanced pressure control units.

Also, the Shaffer "Two-In-One" Down-Hole Tools (Shaffer-Waggener Bumper Safety Joints and Shaffer Jar Safety Joints) are simplifying drilling and fishing jobs wherever difficult operations are a problem!

WRITE FOR HELPFUL LITERATURE that describes the above products in greater detail!

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of gas is rather low, probably around 10%.[7] In certain periods of the pumping life of the well even with this low efficiency, gas may have considerable effect on the power requirements of the system.

This installment concludes the basic, generalized discussion of the sucker-rod pumping system. Discussion of the individual components of the system will begin with the next installment, which will cover sucker rods.

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Next week

How to Program Your Well and Reduce Cost by Using Drilling-Analysis Charts

BY O. E. MECHEM

IMPROVES REFINERY DIGESTION

A refiner recently asked us to help him reduce some of the expenses of operating his cracking tower. The symptoms were fast erosion of the tower itself, and costly catalyst loss in the form of fines. When Houdry engineers dug into the problem, they disclosed evidence strongly in favor of using a less erosive catalyst.

KAO-SPHERES, Houdry Mineral Kaolin Cracking Catalyst in spherical form, were recommended. It took only a very short period after turnaround to show that the remedy was working. Catalyst loss was much less than before, and the smooth, KAO-SPHERES—because they have no sharp edges—also helped reduce erosion of the tower.

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Why not find out?

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The FOREMAN'S PAGE

Quiz on energy

THIS QUIZ concludes the section on energy. Part 1 appeared in the July 18, 1960, issue, and Part 2 in the July 25, 1960, issue of The Oil and Gas Journal.

Please place a check (√) mark opposite the correct answer.

1. A British thermal unit (B.t.u. is
   .... (a) The amount of heat necessary to boil 1 lb. of water.
   .... (b) The amount of heat necessary to raise the temperature of 1 lb. of water 1° F.
   .... (c) The amount of energy necessary to raise 1 lb. of water 1 ft.
2. A unit of power is
   .... (a) A kilowatt-hour.
   .... (b) A pound.
   .... (c) A pound per square inch.
3. The power (energy) consumption of a pump is less with the discharge valve shut than with it open. With the discharge valve shut, the pump
   .... (a) Will run hotter than with the valve open.
   .... (b) Will run cooler than with the valve open.
   .... (c) Will run the same temperature in either case.
4. Which would probably do the most damage if it ruptured? (Assume the drum and its contents are at 60° F.)
   .... (a) A 10 by 30-ft. drum that is **full** of water and ruptures at 500 psig.
   .... (b) A 10 by 30-ft. drum that is **full** of air and ruptures at 100 psig.
   .... (c) A 10 by 30-ft. drum that is **full** of air and ruptures at 200 psig.
5. A refinery pays many millions of dollars each year for energy in the form of fuel, steam, and power. Where does most of this energy go?
   .... (a) To air and salt water.
   .... (b) Into its products.
   .... (c) Stored in cylinders.
6. If a gas turbine is 15% efficient
   .... (a) 85% of the energy put in (fuel) comes out as useful mechanical (work) energy.
   .... (b) 15% of the energy put in comes out.
   .... (c) 85% of the energy put in comes out as heat energy.
7. Which of the following pieces of equipment (may be more than one) should change very little or no energy from **one form** to **another?**
   .... (a) Pump.
   .... (b) Fan.
   .... (c) Electric cable.
   .... (d) Turbine.
   .... (e) Compressed air line.
   .... (f) Engine.
   .... (g) Compressor.
   .... (h) Orifice plate.
   .... (i) Ejector.
8. If a car manufacturer came out with a 200-hp. engine this year much more efficient than last year's 200-hp. engine, which statement is probably true?
   .... (a) This year's car would go a lot faster.
   .... (b) This year's car would have a smaller radiator.
   .... (c) This year's car would have a bigger gas tank.

ENERGY QUIZ ANSWERS

1. (b) The amount of heat necessary to raise the temperature of 1 lb. of water 1° F.
2. (a) A kilowatt-hour.
3. (a) Will run hotter than with the valve open.
4. (c) A 10-ft. by 30-ft. drum that is full of air and ruptures at 200 psig.
5. (b) Into its products.
6. (c) 85% of the energy put in comes out as heat energy.
7. (c) Electric cable. (e) Compressed air line.
8. (b) This year's car would have a smaller radiator.

Here begins a new section, covering principles of . . .

Refinery principles

BASICALLY the chemist seeks to identify and classify materials so that he can apply this knowledge to new and better ways of using existing materials and to ways of creating new materials. You are familiar with similar ways of classifying things from a physical standpoint.

For instance, suppose you had to classify all the buildings in New York City. How would you do it? You might classify them as to the number of stories, or the material of construction such as brick, stone, wood, etc. Or you might classify them according to shape or size—or number of rooms, type of heat, air conditioned or not air conditioned. You could probably list many other ways, and you can see that if you set out to do this you would need some rules to go by.

Here are a few of the rules of chemical classification that chemists have set up through the years.

Definitions

. . . **Elements** are the basic materials from which all substances whether solid, liquid, or gas are made. There are 102 of these basic materials but only 5 of them make up more than 90% of the things in our world. These are oxygen (50%), silicon (25.8%), aluminum (7.3%), iron (4.2%), and calcium (3.2%).

Other elements that are familiar but less common are chlorine, lead, tin, nitrogen, carbon, hydrogen, helium, sulfur, copper, gold, silver, nickel, platinum, iodine, mercury, neon, radium, uranium, and zinc. These and the other less well-known elements are the building blocks of chemistry.

. . . **Compounds** are pure substances made up of the elements. They always have the same composition and the same properties and they cannot be broken down except by chemical action. Some common examples are ordinary table salt which is made of the elements sodium and chlorine; sulfuric acid, which is made of hydrogen, sulfur, and oxygen; and sugar, which is made of carbon, hydrogen, and oxygen.

This material taken from process-training-program manual, Bayway, N. J., refinery of Esso Standard Division of Humble Oil & Refining Co.

HOW TO REDUCE DRILLING COSTS: PART 5

What we know about

Effect of rotary speed on drilling rate

Here, too, knowledge is incomplete and we have to depend on experimental observations to make predictions

BY PRESTON L. MOORE
University of Oklahoma
and
CARL GATLIN
University of Texas

IN THE PREVIOUS installment, we were forced to conclude that our knowledge about the effect of bit weight on drilling rate is incomplete. The same is true for the effect of rotary speed; we must still rely on our experimental observations to make predictions.

For practical purposes, the usual correlations are given as:

$$R_p = a + bN \quad \ldots\ldots\ (1)$$
$$R_p = cN \quad \ldots\ldots\ (2)$$
$$R_p = dN^m\,;\ m < 1 \quad \ldots\ (3)$$

where:

R_p = instantaneous penetration rate
N = rotary speed
a, b, c, d, m = empirically determined constants best fitting the data on on which they are based.

We should restrict our use of these equations to the particular range of N values for which we can get valid approximations. Equation 3 is the most widely used, with $0.4 < m < 0.8$ being the typical range for the exponent.

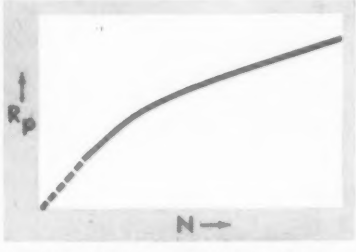
The only theoretical expression available was derived by Outmans[1]:

$$R_p = A/N\,[(1 + BN)^{1/2} - 1]^2 \quad \ldots(4)$$

In Equation 4, A and B are determined from observed data. Unfortunately, the values of these constants (A, B) are quite sensitive to error and must be carefully determined. Moreover, Equation 4 is quite complex compared to Equation 3. As a result, most base their economic analyses on some form of Equation 3.[2]

As Equations 3 and 4 indicate, drilling rate, R_p, increases with rotary speed, N, at a decreasing rate as N is increased. This general relationship is shown in Fig. 1. However, we still lack a completely satisfactory theory and practical equations relating R_p and N are empirical.

Hard to isolate. The effects of rotary speed do not stand out clearly and alone. They are interrelated with the effects of the drilling fluid and bottomhole cleaning. It is difficult, if not impossible, to isolate these effects.



INSTANTANEOUS DRILLING RATE increases as rotary speed increases. However, a higher rotary speeds, the increase in drilling rate is progressively less than the increase in speed. Fig. 1.

Consider, for instance, that at high rotary speeds, a given cutting has less time to clear bottom before being reground by impact of the next tooth. And, the amount of time the cutting takes to clear bottom depends on things other than rotary speed. Clearance time depends on drilling-fluid properties, degree of turbulence (bit hydraulic horsepower, jet-nozzle velocity, circulation rate, etc.) at the bit, and other factors. Thus, we cannot easily discuss rotary-speed effects without also including the other factors which affect chip-clearance time.

In roller-bit drilling there are, however, two variables which apparently depend only on rotary speed. These are the contact time between the bit tooth and the rock, and the **rate of load application.** In making this statement, we ignore any effects of drillstring vibration. Such vibrations may be quite important, but so little is known about them, we must confine ourselves to the other variables.

A roller bit always applies its load at a relatively slow rate. To see this, think of the analogy with a wheel on a car: relative velocity of wheel and ground is zero at the contact point regardless of the car's speed. Still, this rate of loading is proportional to rotary speed and it may have an appreciable effect. Those who regularly test material know well that rate of loading affects the apparent strength of a specimen.

On the other hand, contact time between bit tooth and rock varies inversely with rotary speed. We cannot yet be certain exactly how important this contact time is in the degree of rock damage.

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R H I A

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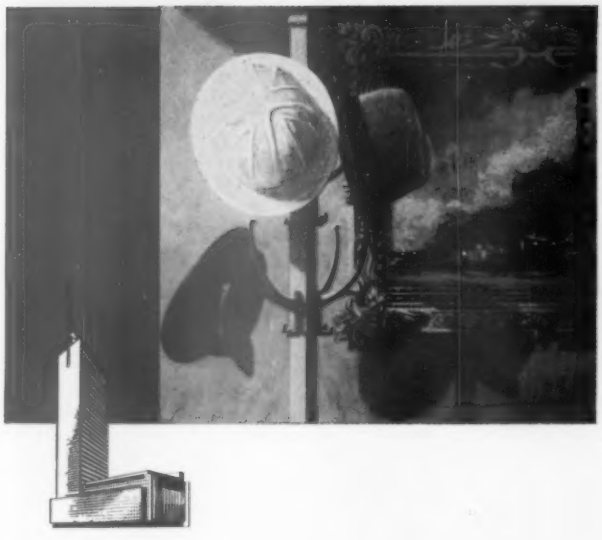

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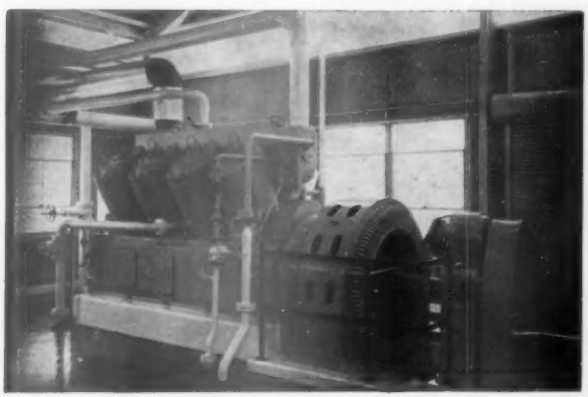

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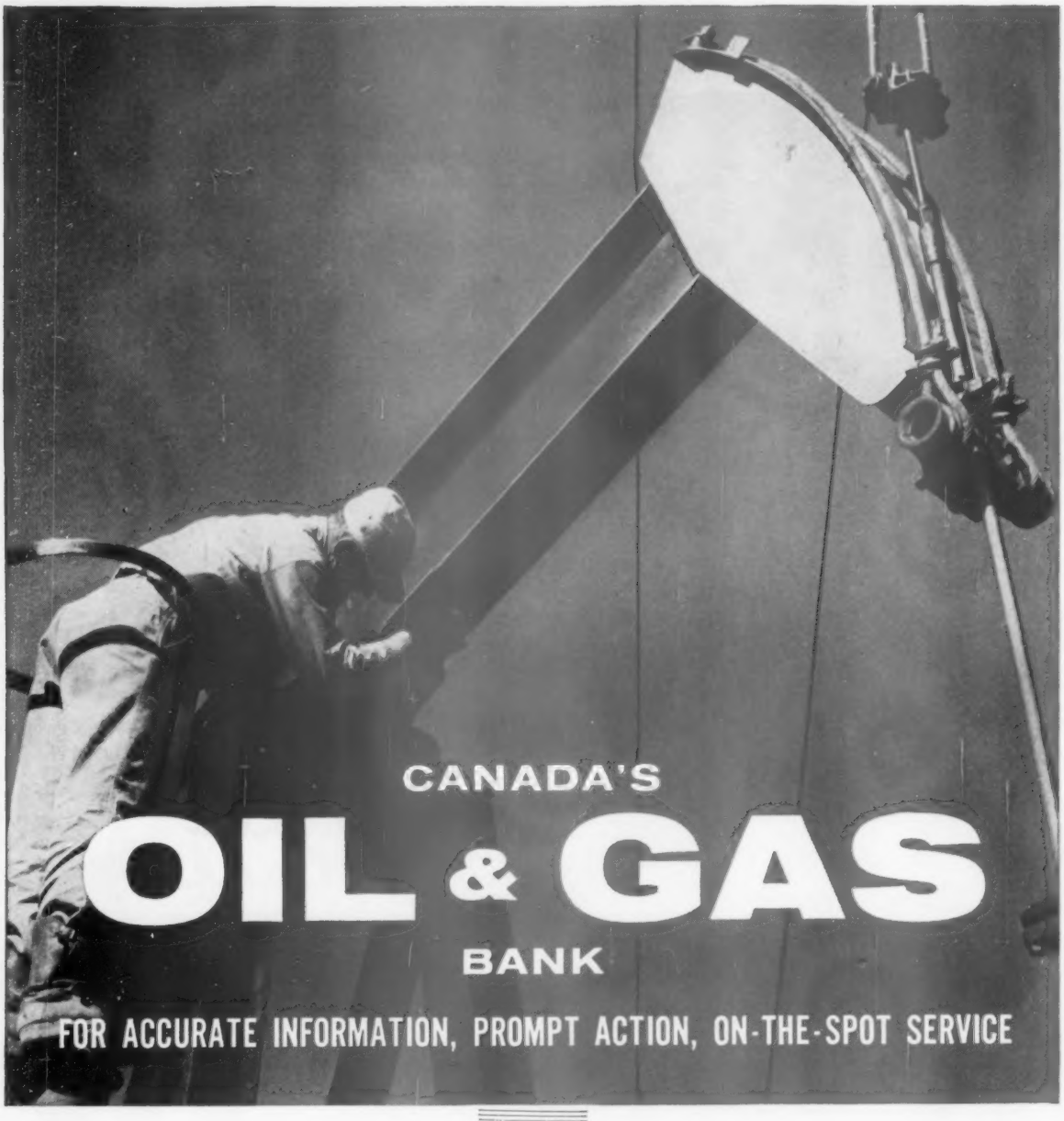

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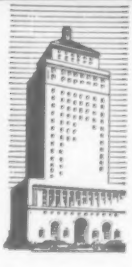

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Maintenance costs dropping in refineries

W. L. NELSON
Technical Editor and
Petroleum Consultant

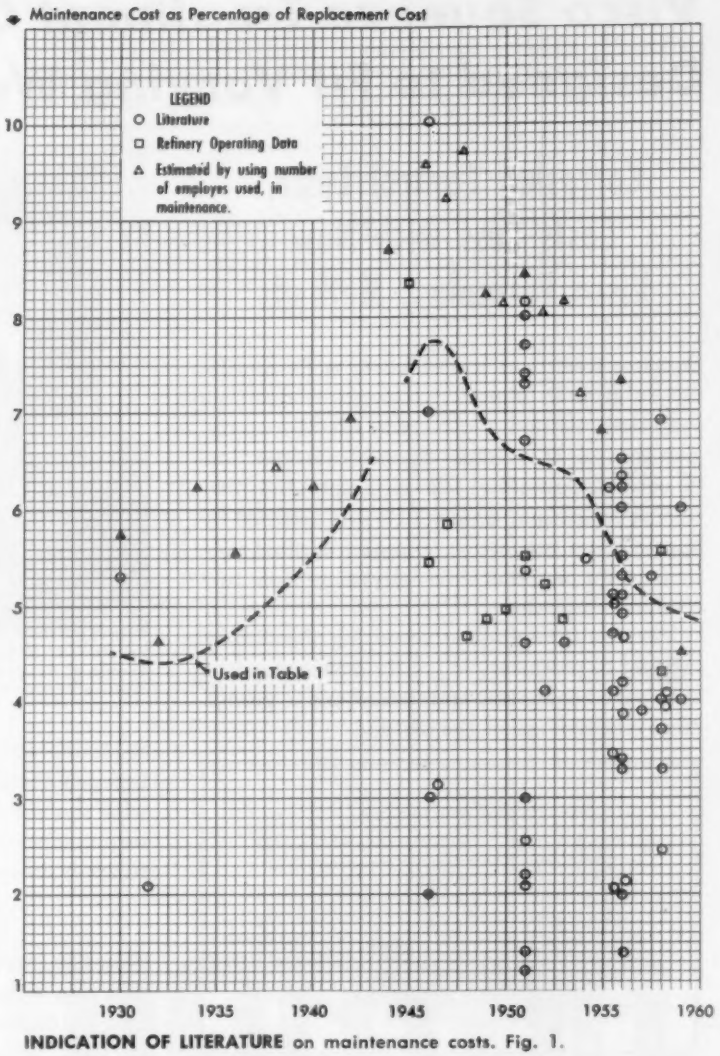
THE YEARLY cost of corrosion to petroleum refiners has been estimated as:

1927	$ 47,700,000[1]
1952	219,700,000[1]
1953	270,000,000[2]
1953	454,000,000[3]*
1954	350,000,000[4]
1956	300,000,000[5]

*Contains more items than other sources.

These figures do not represent maintenance alone, but numerically they are somewhat equal to average maintenance costs. They represent a yearly levy of about 3.84 to 5.47% of the capital investment of the industry.

Amazingly large variations in the



INDICATION OF LITERATURE on maintenance costs. Fig. 1.

TABLE 1—APPROXIMATE MAINTENANCE COSTS AND FIGURES SINCE 1930

Year	Maintenance, per cent of replacement cost: Total	Material*	Labor	Labor % of total†	Manhours per $1,000 maintenance	Material installed $/man hour	Maintenance cents per bbl. crude: Total	Mat.	Average cost of Refinery, $/bbl.
1930	4.5	3.0	1.5	34	362	1.82	4.9	3.2	367
1932	4.4	2.9	1.5	35	505	1.29	4.6	3.0	357
1934	4.5	2.9	1.6	36	458	1.40	4.6	2.9	347
1936	4.7	2.9	1.8	38	447	1.39	4.8	3.0	349
1938	5.1	3.0	2.1	42	415	1.40	5.4	3.1	363
1940	5.5	3.1	2.4	44	417	1.34	6.1	3.4	378
1942	6.1	3.3	2.8	46	396	1.36	7.2	3.9	403
1946	7.7	3.8	3.9	50	353	1.42	11.0	5.5	485
1947	7.7	3.8	3.9	51	318	1.54	11.7	5.7	515
1948	7.2	3.5	3.7	51	281	1.74	11.5	5.6	545
1949	6.8	3.3	3.5	52	262	1.83	11.6	5.6	580
1950	6.6	3.2	3.4	52	254	1.89	11.9	5.7	615
1951	6.5	3.1	3.4	52	256	1.92	12.2	5.9	640
1952	6.5	3.1	3.4	53	229	2.05	13.3	6.3	696
1953	6.4	3.0	‡3.4	53	214	2.20	14.2	6.7	751
1954	6.2	2.9	3.3	54	208	2.21	14.7	6.8	806
1955	5.8	2.6	3.2	55	202	2.24	14.9	6.7	871
1956	5.3	2.4	2.9	55	196	2.30	14.6	6.6	937
1957	5.1	2.2	2.9	56	189	2.32	14.8	6.5	987
1958	5.0	2.2	2.8	56	180	2.42	15.2	6.7	1037
1959	4.9	2.1	2.8	57	173	2.50	15.6	6.7	1080

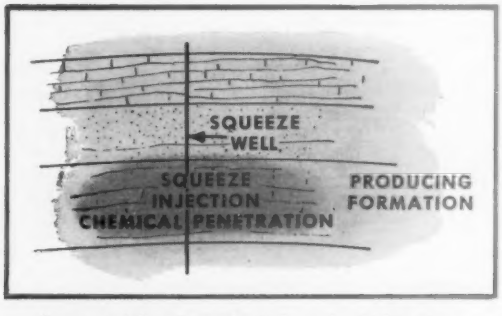
*See references 7, 13, 14, 16-19, and 21-24.
†See references 6 through 20.
‡Reference 27 indicates 2.4-6.4% for 1953.

Visco Squeeze Treatment Chemicals Designed to Fit Varying Well Conditions

Corrosion Control Lasts, Costs Less with New Visco Formulas, Methods

Squeeze treatment in producing wells continues to grow in importance as an economical, long-term method of obtaining effective corrosion control. It is simply the pressure injection of corrosion inhibitor chemical into the producing formation, from which it is released in approximate proportion to produced fluid volume over a period of time—anywhere from two to sixteen months.

Visco has found squeeze treating of sufficient interest to producers to justify development of specialized chemicals and techniques to permit most effective use of the method.



Squeeze technique forces chemical corrosion inhibitor into formation around well bottom. Chemical is carried back with produced fluid. The excellent film persistency of Visco squeeze treating chemicals assures long-lasting, low-cost well protection.

Effects of Formation

Producing formation composition, porosity permeability and position can have an important bearing on the success of squeeze treatment corrosion control . . . They are important considerations in the development of special Visco formulas for this purpose.

Determining Chemical Type

As with any operation affecting producing formations, experience is the most dependable guide. Chances are great that the conditions you have in your area have been closely paralleled by other Visco squeeze treating experience. Further, Visco Formulas such as

Visco's J. P. Stanton, Product Manager for Corrosion Control Chemicals, discusses factors considered important in assuring effective squeeze treatment.

S-1390X, 956, S-1339X, were developed to broaden the effectiveness of corrosion control with squeeze treatment, and so are a big help in pinpointing the best chemical and method to apply to specific well characteristics.

Field Experience

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maintenance costs of refineries are reported in the literature. As an illustration, for the years 1951, 1956, maintenance as percentage of replacement value, ranged thus:

1951	1.2 to 8.2%
1956	1.4 to 6.5%

Differences in types of plants and in kinds of oil can account for some of the range, but methods of accounting and the efficiency of the plant management must also be significant variables.

Process Costimating Nos. 48 and 60 indicate that about 35-45% of the total labor force of a refinery is now used for maintenance. Apparently a smaller percentage of the force (perhaps 28%) was used during 1946. However, such amounts of maintenance labor results in maintenance costs far greater than those of Table 1, whereas most of the maintenance costs reported in the literature 7, 9, 15, 21, 25, 26, are about one-third smaller than those shown in Table 1.

Fig. 1 is included to show the totally unsatisfactory values reported in the literature and to serve as reminder that one must be cautious in the use of averages.

The percentage of the total cost that is represented by labor (see Table 1) is believed to be dependable information but most of the other data are only approximate.

Although the cost of labor represents a larger and larger percentage of the total maintenance cost (see Table 1), the total maintenance cost has been slowly decreasing since about 1946. There is no way to project the data of Table 1 except for short periods, but it seems that maintenance costs will continue downward through 1962.

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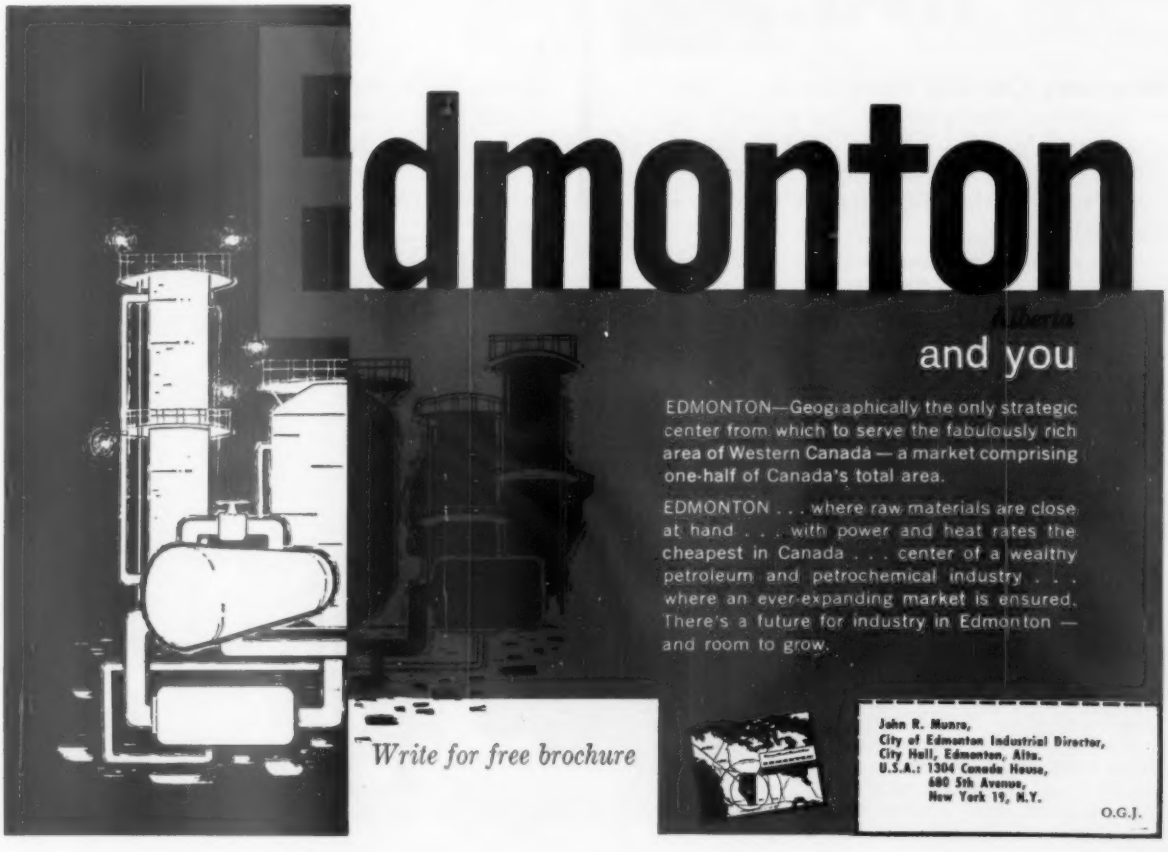
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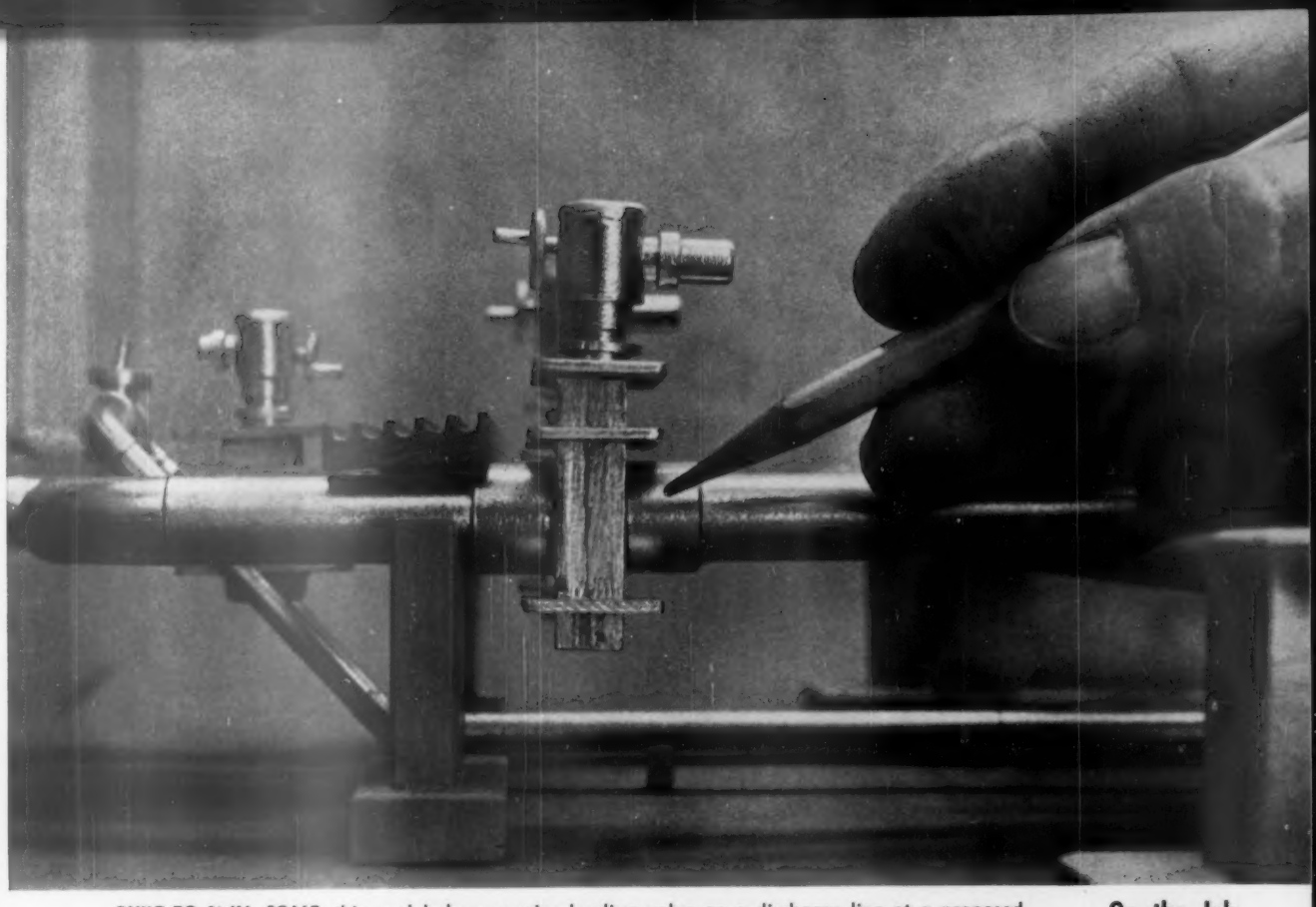
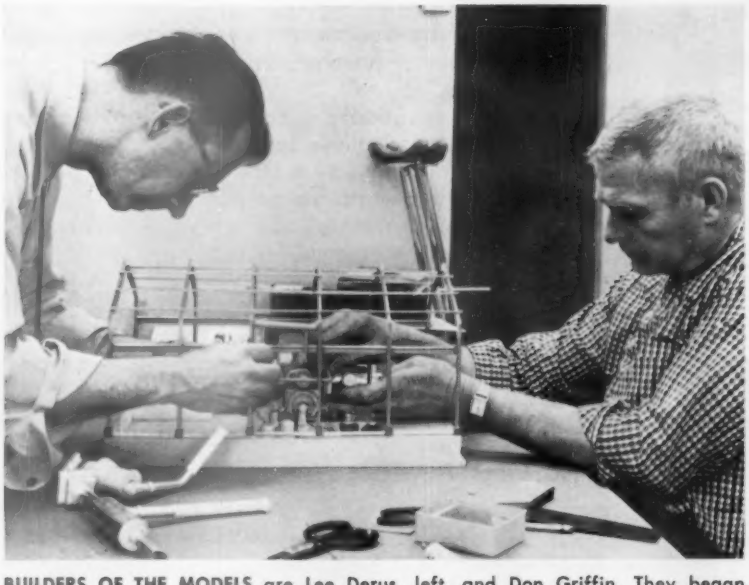


BUILT TO ⅜-IN. SCALE, this model shows engine-loading valve on a discharge line at a proposed Panhandle Eastern Pipe Line Co. station. Use of models help designers visualize practical problems connected with new construction. (Panhandle Lines photos).

On the Job
PIPELINING

Station models reveal design flaws



BUILDERS OF THE MODELS are Lee Derus, left, and Don Griffin. They began building to ¼-in. scale, but found that size too small to work with, and switched to ⅜-in. scale.

SCALE MODELS of compressor engines and buildings can improve design and save money.

Panhandle Eastern Pipe Line Co. is using this technique in planning its 1960 expansion program. This represents for the company a new approach to the problem of minimizing costly design flaws that might not be revealed until the time of construction and installation.

Models have been constructed for two types of engines which will be installed in several main-line compressor stations. The engines will be housed in separate buildings.

S. A. Bergman, chief engineer, assigned two members of Panhandle's engineering section to build the engines and their structures. The idea was that it would be much easier to spot design flaws on a three-dimensional model than on a two-dimensional drawing.

The completed models show all of the exterior component parts of the engines and buildings. They are built to different scales, one to ¼-in. and

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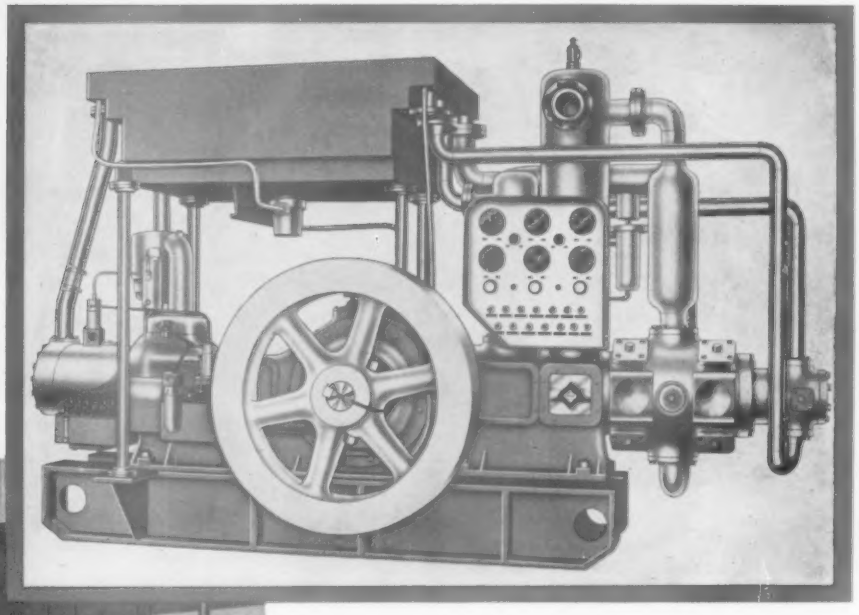

Shown above — the new DPC-60
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DPC-230 Twin-Engine Compressor

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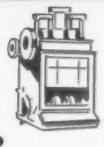

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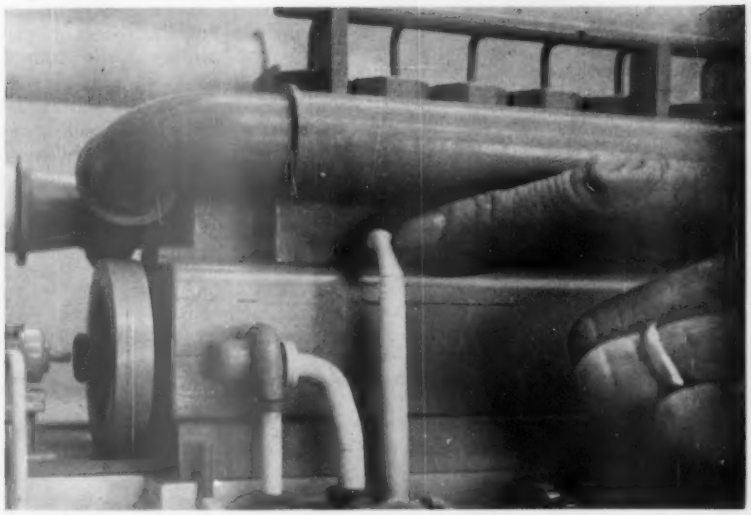


MODELS WERE CONSTRUCTED of many different materials. This jacket-water line, for instance, was made from a section of plastic tubing.

the other to 3/8-in.; the larger scale was used on the second model after trouble was experienced in assembling the first model on the smaller scale.

Design Improvements

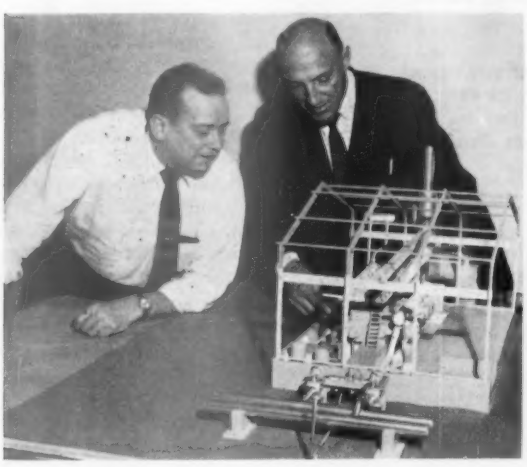
Bergman considers the several months required to complete the models to be a good investment. "Off hand, I can think of at least eight major design changes we've made on the models," he says. "These are in addition to the numerous piping changes that were made."

One design flaw that became apparent early in construction of a building involved crane-support columns that would butt up against six main-building columns to support the crane rail. A study of the model disclosed that the crane-support columns would cut down considerably on aisle space.

After checking with the manufacturer, the builders concluded that it was feasible to increase the size of the main columns, eliminate the crane-support columns, and preserve valuable aisle space. Cost of the change will be insignificant in the over-all cost of the building.

Other flaws not evident on the drawings were spotted by studying the models. In one case a portion of the concrete floor of a building was removed to revamp water piping. The improved design meant a reduction in the number of fittings needed for the line.

Another change was made in the location of a ladder that led to the



CHIEF engineer S. A. Bergman, right, and Senior Construction Engineer Dan Heigele inspect a finished model.

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On the Job

PIPELINING

engine catwalk. The model showed that because of its nearness to the engine suction manifold, the ladder was a safety hazard.

A major piping change was made to preserve symmetry of design. An exhaust line and an air-filter line were relocated to run parallel rather than to intersect at a 45° angle inside the building.

Other Uses of Models

Besides design improvements, the models are serving to aid draftsmen who are not familiar with piping arrangements at compressor stations and who have trouble visualizing final construction from two-plane drawings.

Models also will be made available to contractors before bidding. The models or photographs will serve as guides for the contractor and Panhandle resident engineer during construction.

Model Materials

The model components come from a variety of sources. Some of the valves, fittings, and other parts were purchased from a manufacturer of scale-model materials. Others were products of the builders' ingenuity. They used plastic, balsa wood, plexiglass, solder, dowels, plaster of paris, pencil-lead holders, model-airplane wheels, and stirring sticks from the company coffee room.

A hypodermic needle was used to control the flow of a special cement which fused pieces of plexi-glass.

The model builders used a wheel from a model airplane as a coupling on the hydraulic drive of an engine. Crane rails for buildings are made of lengths of model railroad HO gage track. Horizontal members supporting the common rafters of the buildings were made of balsa of the type used in model railroad construction. An elevated sidewalk on one engine was made of a grooved piece of wood originally intended to hold pencil leads. Solder wire, easily bent into desired shapes, was the answer to a need for a pliable metal to serve as cylinder water lines.

A metal plumbing elbow, cut lengthwise, was used to mold a plaster-of-paris replica of a 30-in. elbow on the air and exhaust line of an engine.

Such improvisations reflect the ingenuity and model-airplane-building background of the model-station builders, Lee Derus and Don Griffin, who are providing Panhandle with an important new design tool.

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The line would run from East Chicago, Ind., to Des Plaines, Ill., to Milwaukee, and on to Green Bay.

There are no products lines in this area. The demand is there but the economics of such a line has been doubtful since it would have to compete with the cheap transportation available on Lake Michigan.

The project, which has been in the planning stages for some time, reportedly is being considered by Pure Transportation and Interstate Oil Pipeline. However, there is expected to be a number of other participants.

Present plans are believed to call for a 16-in. line from East Chicago to Milwaukee and a 10-in. line from Milwaukee to Green Bay.

It is reported that decision to go ahead has not been made and the line may, or may not, materialize.

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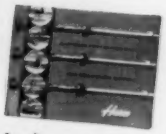

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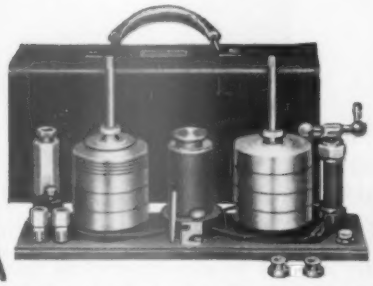

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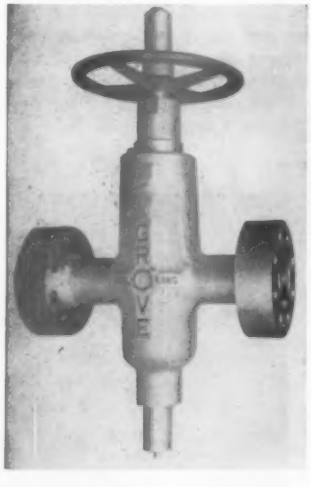
This week's SHOWCASE features . . .

Ditcher fits three-point tractor hitches

. . . and is quickly attached, economical, and rugged, according to the manufacturer. The 3P Pow-R ditcher has a digging capacity of 6 to 16 in. wide and 4½ ft. deep. The tractor-mounted machine features a hydraulic-actuated travel ratchet device that gives full control of digging speed from one control lever.

Power is taken from the tractor's hydraulic system. The power takeoff shaft is equipped with a double-disk friction-slip clutch for digging safety. Source: **Vermeer Mfg. Co., Pella, Iowa.**



Latest valve

. . . for christmas trees and other high-pressure service is this balanced stem type with a solid stem passing completely through the body, so that the gate may move freely up and down with no end surfaces for line pressure to act against. The balanced stem consists of two shafts placed opposite each other and leading in from the top and bottom of the body. They are linked together by the gate. The valve, added to the maker's G-2 valve line, comes in sizes from 1 5/8 through 2 9/16 in. rated at 10,000 lb. w.o.g. and with a choice of ring-joint flanged ends or special end connections. Source: **Grove Valve & Regulator Co., 6529 Hollis, Oakland, Calif.**

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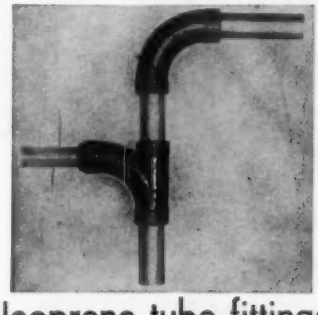

Neoprene tube fittings

. . . for use in commercial vacuum cleaning and pneumatic conveying installations have just been made obtainable. The maker claims that 10 months of testing his Neo-Flow fittings have shown that practically no deterioration is experienced in the flow of highly abrasive materials.

Available in diameters from 2⅛ to 4 in., the fittings are also said to save in erection costs due to their ease of assembly and snug fit, while doing away with the need for mastic materials, welding, or brazing. Source: **Automatic Tube Co., 87 McClea Ct., San Francisco.**

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Final-drive unit

. . . just disclosed is designed to position valves, dampers, and other control devices on heating and processing equipment. The Type 77MS unit develops up to 400 lb.-ft. of operating torque and 800 lb.-ft. stall torque with

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a 45-psig. air supply, the maker reports.

The drive unit can be pneumatically or electrically controlled. A characteristic cam relates the per cent of drive-lever rotation to per cent control-signal change. Source: **Republic Flow Meters Co., 2240 Diversey Parkway, Chicago 47.**

•

Wheel measures distance quickly

. . . and is designed to measure relatively smooth surfaces. Ideal for use by

construction contractors and maintenance men, the 202 measuring wheel measures from wall to wall as well as line to line, recording the total distance in feet and inches by a built-in totalizer and a recessed scale on the circumference.

An audible click every 2 ft. and a loud bell indicate the 100-ft. mark. A zero reset knob permits presetting for a desired distance. The handle extends and locks at a 34-in. height, yet it folds for easy and compact storage. Complete with a leather carrying case, it weighs 2¾ lb. and retails for $29.75. Source: **Lufkin Rule Co., Saginaw, Mich.**

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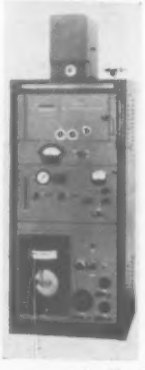
Gas chromatograph



. . . just introduced, the Model 17, permits column operation from ambient to 500° C. Two symmetrically heated columns are used. One column is used for analysis and the other discharges through the reference detector for column vapor pressure compensation.

Both columns are identical and are symmetrically heated. During temperature programing the column packing vapor pressure increases at the same rate in each so that the column partial pressure background signals at the reference and the sample detectors are equal and opposite. This results in the cancellation of the temperature - dependent background signal. Source: **Loe Engineering Co., Box 234, La Canada, Calif.**

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Steam-tracing product

. . . is this one-piece, extruded section, called Duotrace, which contains two integral channels flanking a large, product-carrying pipe area. The product offers a way to simplify and reduce the cost of recirculating heating fluids required in piping systems.

The heating medium can travel through one small oval passageway to maintain a desired temperature of bulk material in the product line to insure free flow. The tubular product comes in 2, 3, and 4-in. pipe sizes. Source: **Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.**

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New combination motor starters

. . . circuit breakers, and combinations of both have just been placed on the market. Designated Model 60, Series ECS Pylets, all types are explosion-proof, dusttight, and weather resistant for indoor and outdoor use. They feature cast-aluminum threaded enclosures with stainless-steel exteriors for weather protection and corrosion resistance.

The enclosure consists of a central body externally threaded at the top to accept the internally threaded overlapping dome which provides natural shedding of water or process drippings. The body is oppositely threaded at the bottom to duplicate the water-shedding effect through overlapping the externally threaded inverted lower dome. Threads are of the square or buttress Acme type to do away with seizure and crossthreading. Both domes have a safety interlock to prevent inadvertent opening of the enclosure in hazardous locations when the operating handle is in the "on" position.

A glare shield cast integral with the body, for better observation of the pilot light, provides additional weather and mechanical protection. The operating handle is arranged to take three padlocks in either the "on" or "off" position without interference with the trip-free action of the circuit breaker. Source: **Pyle-National Co., 1334 N. Kostner Ave., Chicago 51.**

•

Protection

. . . for casing threads is offered by a new neoprene clamping device, called the Klampon thread protector. It consists of a high-strength alloy-steel band molded inside an oil-resistant neoprene protector and an adjustable cam type of latch assembly for manual locking and unlocking of the protector around the external threads of the casing. A spiral hook in the latch handle is used to return the protector assembly from the derrick.

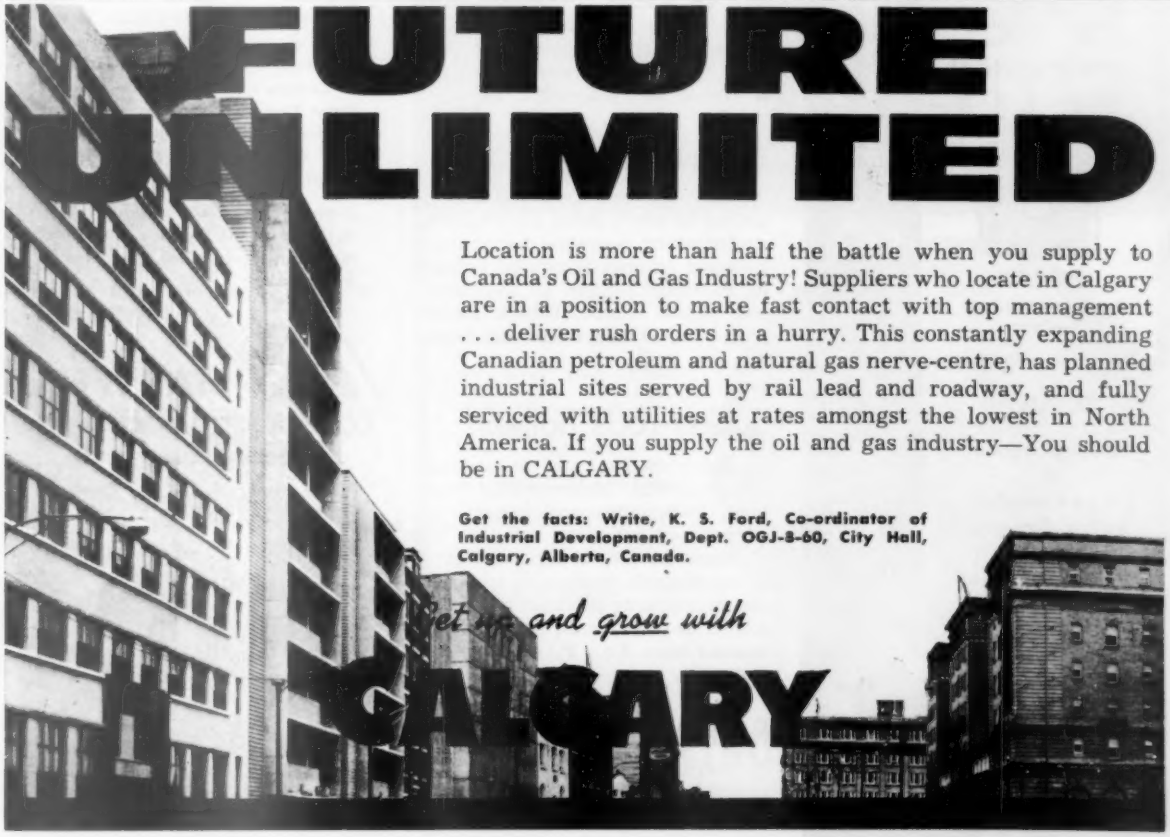
The device is available only by rental in the United States but is to be sold elsewhere. Source: **Klampon Corp., 1315 E. 23rd, Signal Hill 6, Calif.**

•

Oil saver

. . . installs easily without the need to cut a line, offering a way to minimize installation time for oil savers and save in wireline stripping costs. The Blue Top oil saver promises other advantages too.

Rubber wear is compensated by hydraulic pressure furnished with a standard grease gun. The device has all-steel construction, and exposed parts are plated to resist corrosion. The wiping action may be one or two stage. Wear parts are easy to get to for replacement. The clearance inside is sufficient for a 1¾-in. rope socket. Source: **Saunders Brothers, 112 S. Pickering, Whittier, Calif.**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SHOWCASE . . .

New Literature

Four basic pipeline strainers

. . . for condensate, steam, water, oil, air, gas, and other piped fluids are covered in Bulletin 1210, just off the press. The four-page literature piece details construction and operating features of a range of Y-type strainers designed to protect steam traps, pumps, control valves, compressors, and other equipment against dirt, scale, or metal chips in pipelines. Featured is a new cast-steel strainer for pressures to 600 psi. Source: **Sarco Co., Inc., 635 Madison Ave., New York 22.**

Pneumatic instruments

. . . for the process industries are described in new 12-page Catalog 515 recently announced. It includes pressure and temperature pilots and pneumatic transmitters, pilot specifications, control actions, optional indicating-controller features, and pressure and temperature-transmitter specifications. Photographs highlight mechanical construction features of the instruments and diagrams show case dimensions and mounting arrangements. Source: **U. S. Gauge Div., American Machine & Metals, Inc., Sellersville, Pa.**

Circuit-breaker

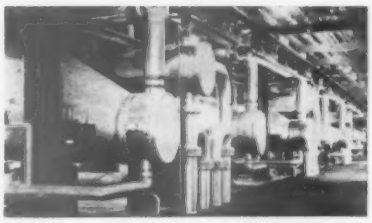
. . . enclosures are illustrated and described in new Catalog 17, yours free for the asking. A general description of exclusive features is offered followed by illustrated sections on three available styles. Source: **Killark Electric Mfg. Co., Vandeventer and Easton Ave., St. Louis.**

Sucker-rods bulletin

. . . shows chemical analysis, mechanical properties, recommended maximum loads, sizes and weights, and methods of extending rod life. The literature features a discussion of alloying elements, mechanical properties, and heat-treating processes as they are related to sucker rods. Source: **Continental-Emsco Co., P. O. Box 359, Dallas 21.**

Radiation-detection

. . . instruments booklet features three transistorized, battery-operated instruments which should prove of interest



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Consider the advantages of dealing with Marwell Construction on the really big projects:

* One contractor for all phases of construction from blueprint to delivery.
* An integrated operation skilled and staffed in all departments.
* Proven performance on many of Canada's greatest projects.

Monuments to Marwell in steel and concrete and hewn out of solid rock are legion throughout Western Canada, The Yukon and Alaska. In the field of petro-chemicals, the name of Marwell is associated with some of Canada's largest developments—Trans Canada Pipe Line, Westcoast Tranmission Company, Trans Mountain Oil Pipe Line, Pacific Petroleums, Standard of B.C.

Examine Marwell's record before deciding on the big jobs in Canada, Northwest Territories, The Yukon and Alaska.

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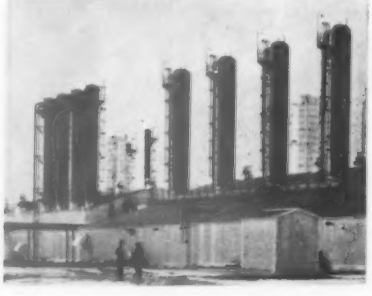


to laboratory personnel working with radioisotopes, plant safety persons, or engineers using radioactive gages and instruments. The four-page literature piece gives prices, specifications, and photos. Source: **Gelman Instrument Co., 106 N. Main St., Chelsea, Mich.**

Subsurface hydraulic pump

. . . now available, is featured in a new 20-page bulletin now being offered to interested persons. Listed are pump descriptions, special features, operation, and maintenance data. Also included in the bulletin are clamps, stuffing boxes, anodes, dynamometers, and weight indicators. Source: **Johnson-Fagg, Inc., P. O. Box 7157, Tulsa.**

Technical literature on Viton

. . . as it is used in seals and gaskets, has just been made available. It covers such features as temperature ranges, physical properties, and resistance to aromatic solvents, aliphatic hydrocarbons, oils, and several oxidizing materials. The literature notes various copolymers and elastomers in which Viton is a principal component. Source: **Stillman Rubber Co., 5811 Marilyn Ave., Culver City, Calif.**

Pressure

. . . liquid-level transmitter Bulletin P-36-1 describes the Model P transmitter, capable of measuring pressures as high as 250 psi. or ranges from as low as 0 to 100 in. of water. The publication shows typical applications and design features of the instrument. Source: **Conoflow Corp., 2100 Arch St., Philadelphia 3.**

Electric winch-hoist

. . . Bulletin M-60 presents nine ways to use the 60-lb. My-Te portable electric winch and hoist, designed to lift 2,500 lb. or to pull 5,000 lb. The unit is made to mount on almost any object with just six bolts. It works off a 6 or 12-volt battery. Source: **City Engineering Co., Inc., 3547 Massachusetts Ave., Indianapolis 18.**

Tube expander

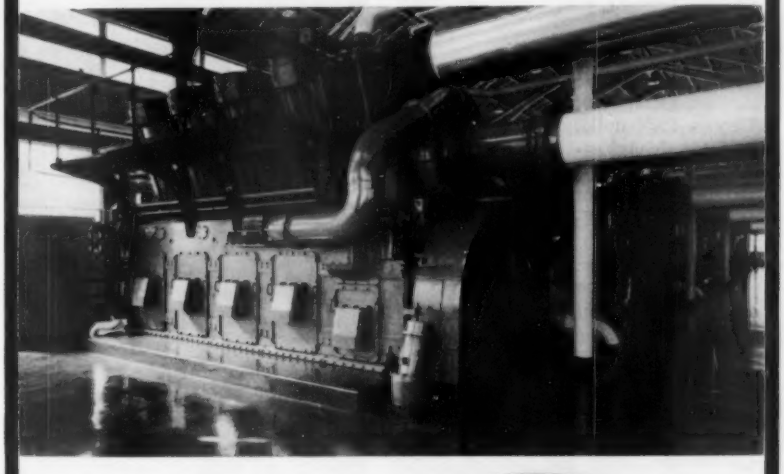
. . . Bulletin TX-60 (2 pages) features the Model F self-feeding unit, and includes descriptive data and a full page of tube-expander specifications. Source: **Vernon Tool Co., Ltd., 1101 Meridian Ave., Alhambra, Calif.**

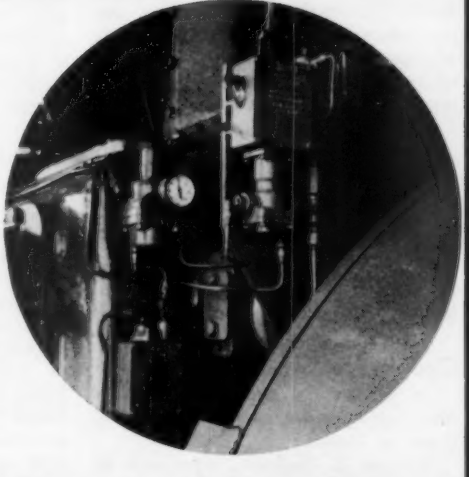
Let **AMOT CONTROLS** "Stand Watch"

With the ever increasing emphasis being placed on improved safety and automatic systems by engine builders and pipe line transmission companies, AMOT CONTROLS are being specified more and more for the protection of vital equipment.

All major domestic engine and compressor manufacturers offer AMOT products either as standard or optional components of their control systems.

Why not call your AMOT representative for suggestions on your control requirements? Better still, specify AMOT to your equipment supplier.





Shown in these installation photographs are 2000 H.P. Cooper-Bessemer Compressors at a new Tennessee station of the American Louisiana Pipe Line Company.

AMOT CONTROLS CORPORATION

FIRST STREET & NEVIN AVENUE • RICHMOND, CALIFORNIA

▶▶▶ Equipment Men Notes

Howard Kaylor is promoted

. . . to the position of field sales manager for the oil-field equipment plants of Parkersburg Rig & Reel Co. Formerly product manager of the Parkersburg Hydromatic Brake-Hydrotarder product group in Coffeyville, then product manager of the company's production equipment plant in Houston, Kaylor now assumes responsibility for oil-field sales activities, including personnel sales training.

Prior to joining Parkersburg in 1959, he was with Union Oil of California, Creole Petroleum Corp., and, for the past 14 years, with Standard Oil of California.

Russell D. Vaught to manage

R. D. Vaught

. . . the Oklahoma, Texas Panhandle, and North Arkansas operations of Drilling Equipment Mfg. Co., according to Cliff Knight, general manager. A Demco employe since 1953, Vaught was formerly the firm's Oklahoma field representative.

Joseph B. Willmering takes post

. . . as assistant manager—oil-country-tubular products for United States Steel's National Tube Division, reports James H. Degnan, manager of oil-country-tubular products. A veteran of 38 years with National Tube, Willmering began his career in the St. Louis district sales office in 1922.

He subsequently became office manager and special tubing salesman there before being transferred to the Pittsburgh headquarters in 1938. In 1941 he was named special products sales supervisor, and most recently has been manager of administrative services for the sales department.

Geophysical Service Inc. names

. . . a geophysical supervisor in Madrid, Spain, and a personnel administrator in Dallas.

William E. Dickson, supervisor in Madrid, will be responsible for operations of GSI exploration field parties in the Spanish Sahara. Formerly in GSI's London office, he has been with the company since 1931. Prior to his London assignment, Dickson was seismic operations supervisor in Canada.

Lewis Sole, a 25-year company veteran, will join the personnel department in Dallas as administrator for field parties in the Eastern Hemisphere and Latin America. Sole has been a seismic party chief the past 10 years.

NEW DIRECTORS named to Western Co.'s board are, from left: John S. Brown, Roscoe Clark, Jr., Dr. Ernest Dale, and Charles S. Leonard. At the far right is H. E. Chiles, Western president and board chairman.

Oil Equipment Mfg. Co. enlarges

. . . and modernizes its plant and offices in Louisville. A large extension has been added to the manufacturing, storage, and shipping departments of the firm, and offices, drafting, and engineering departments are now housed in a spacious two-story building. The Kentucky firm manufactures balanced loading assemblies.

Robert A. Rath elected veep

R. A. Rath

. . . in charge of sales of Spang & Co., Butler, Pa. manufacturer of cable tools for oil, gas, and water-well drilling. He had been sales manager of Butler Refractories, a Spang affiliate. Prior to that he was Pittsburgh district sales manager of Laclede-Christy Refractories, coming from U. S. Steel Corp., where he held various positions over a 10-year period. The Spang board also confirmed the reappointment of Harry L. Taylor as sales manager.

C. J. Erwin is appointed

. . . district sales representative in South Louisiana for the Fishing Tool Division of Wilson Supply Co. R. E. Cabiness takes over as Houston area sales representative.

Erwin, who will locate in Lafayette, La., was a division manager for another service firm prior to joining Wilson. Cabiness previously was assistant drilling and production superintendent for West Production Co. More recently he was engaged in city and field sales for a rental-tool firm in the Houston area.

Welex, Inc. forms subsidiary

. . . company, International Inspection, Inc. (or Triple-Eye) to specialize in ultrasonic inspection of oil-field-tubular goods and refinery and petrochemical-plant piping and vessels for corrosion. Welex, wireline service company with headquarters in Fort Worth, is a division of Halliburton Co., Duncan, Okla.

Triple-Eye recently purchased all ultrasonic patents, processes, and other assets of Electro-Circuits, Inc., a former subsidiary of Automation Industries, Inc., Los Angeles.

Officers and directors of Triple-Eye are: Ray O. Shaffer, chairman of the board; Walton J. Greer, vice chairman; J. Randolph Richards, president; H. K. McArthur, executive vice president; and T. G. Bogle, vice president in charge of sales and advertising.

Brill Equipment Co. moves

. . . to Newark, N. J., from its former location in New York City. Integrated in the new location are warehouses and rebuilding shops along with sales and executive offices. All facilities are on ground level. There is no change in the location of Brill's branch in Houston.

Roy R. Rohrer is boosted

. . . from sales representative to district manager in Houston by Western Supply Co., while Joe B. Byrd has been added to the Houston staff, reports Earl J. Coulter, vice president of the Tulsa firm. Rohrer has been with Western in Houston since 1958. He was previously with Taylor Forge & Pipe Works and L. B. Foster of Houston, and operated his own sales representative's business in the Houston area. Byrd was formerly with Vinson Supply.

R. R. Rohrer

Ray V. Long is elected president

. . . and general manager of Vapor Recovery Systems Co., filling the vacancy created by the recent death of his father, Frank V. Long, Sr. Long has served as executive vice president of Varec since last January. H. Dickinson, former vice president of engineering, was named to the board of directors as corporation vice president.

Ray V. Long

Salt Water Control, Inc. appoints

. . . rental and service representatives in Canada and South America.

Handling Swaco D-Gassers in Canada is Native Solids Controllers, Ltd., headed by Scarborough Hartley with offices in Calgary, and Mickey D. Parker, with offices in Edmonton.

Swaco sales and service in Colombia are now being handled through an arrangement with Magnet Cove Barium Corp. which has a full complement of personnel and facilities in that country through Sudamericana de Perforaciones y Servicios C.A. (Superser).

Linde Co. plans to expand

. . . its oxygen-producing facilities this year with the installation of a new on-site plant in Pueblo, Colo., which will supply more than 200 million cubic feet of oxygen per month to Colorado Fuel & Iron Corp.'s plant. Since 1955, Linde has been installing on-site plants at a rate close to one per month.

BrakeSol products being made

. . . and distributed in Canada by BrakeSol Canada, Ltd., in Calgary, Alta. Products include: paraffin-treating chemical for control of wax in tubing lines and tanks; D-7 demulsifier for separation of water and salts from crude; and Stim-Foam for removing water, emulsion, mud and paraffin blocks from the formation and to open up injection wells in floods to assist in secondary recovery.

Pat Curtin, BrakeSol division treating engineer with headquarters in Edmonton, will service the products in British Columbia, Alberta, and Saskatchewan.

CONDUIT GATE VALVE, which could be the largest ever to be put in pipeline service, is a 36-in. valve over 18 ft. tall and weighing 20,875 lb. Recently completed by Grove Valve & Regulator Co., it's being purchased by the Peoples Gas, Light & Coke Co., Chicago, and will be used in the natural-gas-pipeline network serving the Chicago area. Standing alongside the valve are Grove President Marvin Grove and Vice Presidents Austin Bryant and George Doty.

O. W. Stanley is branch manager

. . . of Cooper-Bessemer Corp.'s Odessa, Tex. branch office, announces George Edick, domestic sales manager. In his new capacity he will direct C-B's field sales and service activities in the West Texas area, and will report directly to C. H. Sanders, southwest district manager.

O. W. Stanley

Stanley fills the post vacated by C. L. McDougall, who has been named the corporation's assistant parts sales manager at Mount Vernon, Ohio. Stanley has been a sales engineer in C-B's Houston office.

General Electric Co. schedules

. . . its second annual turbine seminar in New Orleans starting September 22. Objectives are to present information on new turbine application and engineering developments and to encourage an exchange of ideas between representatives of the petroleum and chemical industries and key marketing and engineering personnel of General Electric.

Parkersburg Rig & Reel makes

. . . a complete reorganization of the Coffeyville, Kans. plant's executive staff. Now heading up the Coffeyville operations is Jess Kern, former plant manager. In his new position as marketing manager, he is responsible for engineering, manufacturing, production, and all sales services, including pricing and advertising, for the plant.

Jess Kern

Managing the engineering and sales services department is Gene Kaefer, previously product manager of the company's Hydromatic Brake-Hydrotarder product group. He will be in charge of engineering order and inquiry service, and will also supervise the Parkersburg pumping unit and Hydromatic Brake-Hydrotarder product groups.

E. W. Brant joins sales force

. . . of W. C. Norris, Mfr., division of Dover Corp., Tulsa. He has been assigned to the company's Gulf Coast sales division and will headquarter in Houston. Brant has been associated with oil-field-equipment sales for over 30 years.

Smith ROCK BITS

TOPS ON BOTTOM

MORE FOOTAGE

FASTER PENETRATION

FULL-GAGE HOLE

Smith TOOL CO.

COMPTON, CALIFORNIA
Branches in Principal Oil Centers
Throughout the World

Here are pointers on . . .

Safety and drilling mud

THE GENERAL FUNCTION of drilling mud, in regard to safety, is to prevent any formation fluids—water, oil, or gas—from entering the bore hole and causing a blowout.

High costs will result from loss or damage to equipment or property, but most important is the danger to the lives of employes which may occur during blowouts.

Several factors are necessary for a safe drilling mud.

Density. It is commonly believed that all that's necessary of a drilling mud is for it to have sufficient density to overcome known or anticipated formation pressures. This is an erroneous assumption. There is the possibility of drilling through highly fractured zones, cavities, or porous sand or gravel formations where lost circulation results. Then it is possible that the fluid level in the hole is appreciably lowered to a point below a high-pressure oil or gas zone and a blowout will occur unless an alert crew prevents this possibility.

Density alone is not always the cause of lost circulation. It is an accepted fact that running in the hole with a high-gel mud can cause weak zones to break down and cause lost circulation. Only proper control of gel strength lessens this hazard.

Withdrawal of drill pipe from the hole often can cause a blowout merely by lowering the hydrostatic head. Good mud control can lessen this danger by maintaining a low filter loss which deposits thinner wall cakes, and by proper viscosity regulation resulting in bits which are not balled up. Control of gel strength can eliminate the swabbing action created with poor muds when the drill pipe is pulled out of the hole.

One of the saddest plights is caused by human failure when the hole isn't kept full. A blowout caused under this condition is inexcusable, no matter how good the mud, because reduction of the hydrostatic head to a dangerously low point is an invitation for trouble. This can be avoided only by proper training of the crews. Safety's leading role is to keep the crews well informed and properly educated as to good drilling practices and techniques.

Use and handling of chemicals. Chemicals used in oil-well drilling present a challenge to a good safety record. Probably the most dangerous of the commonly used chemicals is caustic soda. It is dangerous to handle as it causes many minor burns that are painful and often men get flakes of caustic in their boots or gloves. Little can be done to prevent minor burns except using extreme caution. The real danger lies in the threat to eyes. One flake can injure an eye permanently and the best protection is the wearing of goggles.

A few of the chemicals used are toxic. Materials such as barium hydroxide, which is used for treating hard water, are best protected against by the use of face masks. Other additives may irritate the nose and eyes but are not harmful. In this case, the individual should determine whether to wear a face mask.

Even with modern-day shipping procedures — where heavy loads are mechanically loaded on pallets, the pallets shipped, and then unloaded by mechanical trucks—what causes the accidents? Here's what we saw recently: After all the planning, cost, and effort by the vendors to offer merchandise in 50-lb. sacks, two roughnecks were moving some chemical. They were both walking on a wet walk in muddy boots, one carrying two sacks and the other "saving time" by carrying three sacks!

Since as lifting mud-weighting materials is the basic source of many accidents, a study of transportation methods may eliminate some of the lifting required. In one instance, weight materials were shipped on small pallets that could be handled with hand trucks. Near the hopper on location, a ramp was dug in the ground and the truck was offloaded at ground level. Using a hand truck, the sacks were wheeled to the hopper and stacked next to it.

The point of storage and the point of use should be as close as feasible. How many times has the chemical been stored where it is necessary to carry it over an obstacle course—a maze of pump suctions and lines—to the chemical tank which is perched on

Modified from a paper presented by R. D. Updyke, mud engineer of Richfield Oil Corp., at the Western Oil & Gas spring safety conference in Bakersfield, Calif., 1960.

B and W Inc.
SCRATCHERS AND CENTRALIZERS
for a good cement job

CHANNELING
is defined as . . .

CHAN'NEL.ING 1. To form a channel in; to groove. 2. To convey into or through a channel or channels. 3. Oil Well Drilling. In well cementing, a condition resulting from incomplete removal of fluid, gelled mud and filter cake from behind the casing by the ascending cement slurry.

CHANNELING MEANS . . .

(1) An imperfect primary cement job
(2) Mud left behind the casing
(3) Expensive squeezing
(4) A poor completion

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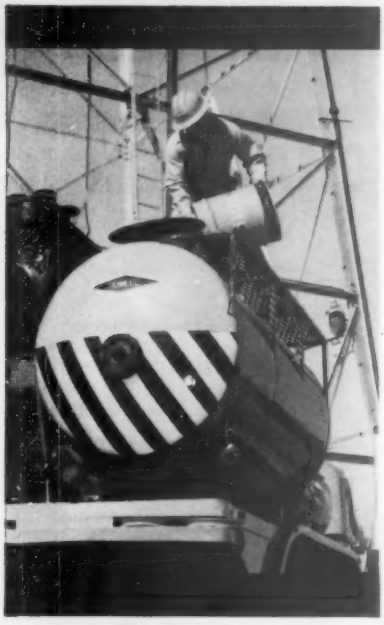
WATER BLOCK?



FREFLO

Freflo®—the Dowell product designed to remove water block—acts three ways to help you increase well production. First, Freflo reduces surface tension. Second, it attacks interfacial tension, makes the water and oil more compatible. And third, Freflo breaks emulsions and prevents them from re-forming. Freflo is economical; the 10-gallon steel drum contains enough Freflo for 1000 gallons of treating solution. Available at all Dowell stations.

Products for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

DIAL DOWELL

the ditch with no safe catwalks around it?

Mud guns are another hazard and they should be inspected regularly. Mud guns have been known to blow off the line, while in use under pressure, and break the user's arm.

Objectives of a sound safety program. The sole purpose of any safety program is to eliminate injury-causing accidents. It may be humanely impossible to completely eliminate all accidents, but the proper approach will minimize conditions that are largely responsible for miscues. Any reduction in the accident frequency is a step in the right direction.

All hazards should be recognized. The supervisory program should include proper advisement of all hazards, protective measures to guard against them, and continually informing and educating all personnel of good safety practices.

Active Rigs*

	Rotary	Cable	Total†
Alabama	5	1	6
Alaska	5	0	5
Arizona	1	0	1
Arkansas, South	25	0	25
California, Offshore	5	0	5
Inland	111	2	113
Colo., excl. Four Corners	19	4	23
Four Corners	12	1	13
Florida	2	0	2
Georgia	2	0	2
Idaho	0	0	0
Illinois	36	18	54
Indiana	15	28	43
Kansas	105	9	114
Kentucky, Western	3	47	50
Louisiana, North	105	0	105
South Inland	224	0	224
Offshore	57	0	57
Michigan	47	42	87
Mississippi	63	0	63
Nebraska, West	21	0	21
Nevada	3	1	4
New Mexico, East	82	28	110
West	37	10	47
North Dakota	15	0	15
Okla., Panhandle	25	8	33
Ohio	8	116	124
Oregon	1	0	1
South Dakota	1	1	2
Texas, Offshore	1	0	1
East	60	0	60
Upper Gulf Coast	87	0	87
North	104	1	105
Panhandle	45	6	51
Corpus Christi	134	0	134
San Antonio	30	4	34
West	203	15	218
West Central	87	17	104
Utah, North	10	0	10
South	12	0	12
Washington	1	0	1
West Virginia	6	215	221
Wyoming	68	7	75
Reported U. S. total	**1,881**	**581**	**2,462**

*Report to AAODC by the International Oil Scouts Association.

†As of July 29, 1960.

Not reported: Iowa, Missouri, Montana, Nebraska-East, Oklahoma—except Panhandle.

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11 Models
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5¼" to 22" travel

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6 Models
30 to 100 tons capacity
3¼" to 10" travel

ROL-TOE FOOT-LIFT HYDRAULIC JACKS
3 Models
10 to 50 tons capacity

RE-MO-TROL PULLERS
Solid and Center-Hole Rams
39 Models
10 to 300 tons capacity

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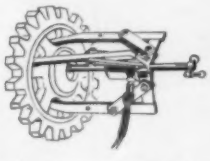
9 Models
1¼ to 20 tons capacity
13½" to 19" travel



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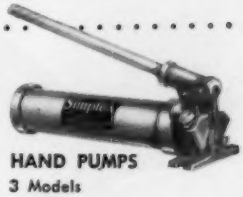
4 Models
20 and 30 tons capacity
Push-Pullers, Double and Triple-Grip Pullers

POWERED PUMPS ELECTRIC, GAS OR AIR—6 Models



HAND PUMPS
3 Models

Look for further information on Lever and Screw Jacks in other advertisements.

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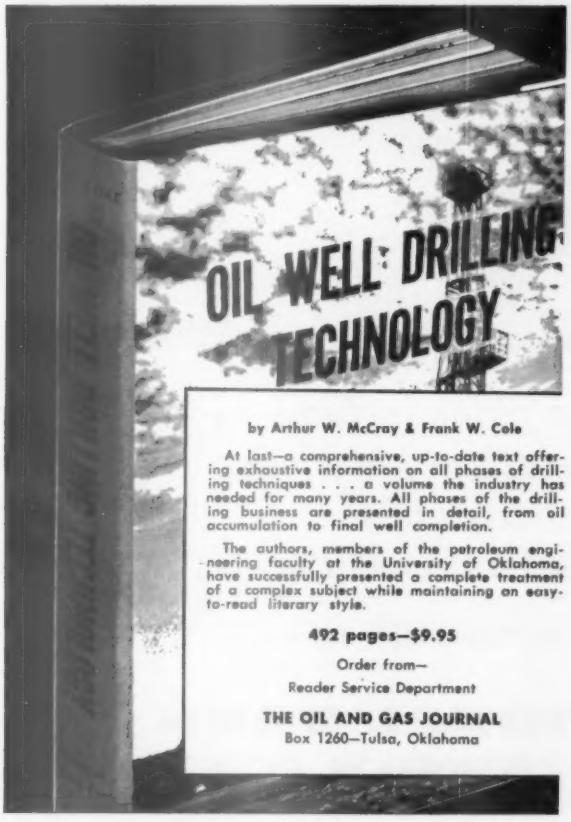
A. C. Templeton, 5627 Del Roy Drive, Dallas, Texas



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The authors, members of the petroleum engineering faculty at the University of Oklahoma, have successfully presented a complete treatment of a complex subject while maintaining an easy-to-read literary style.

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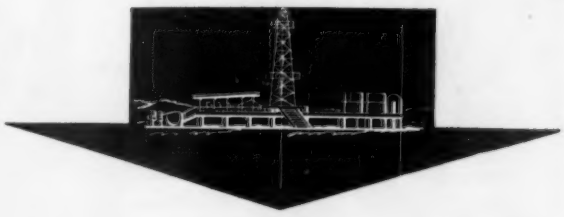

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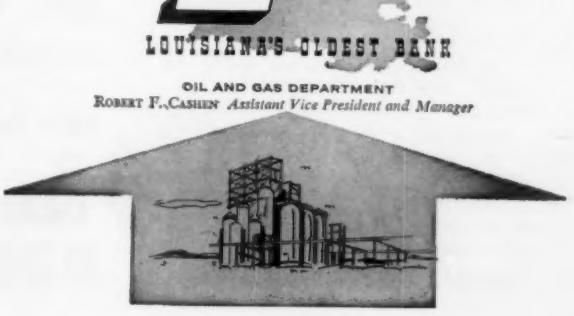

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ALONG THIS 30-MILE TREND northwest from Calgary, a major Cardium Cretaceous oil field appears to be on its way.

Cardium finds its way to gates of Calgary

BY JOHN C. McCASLIN

HUGGING the Cremona Oil Pipeline for 30 miles from Calgary northwest to Carstairs is one of the most active and interesting off-season oil plays in Canada since Pembina. There are 11 rigs either drilling for the Cardium or evaluating the Cardium on the way down to the area's prolific Mississippian gas storehouse.

Major play moves fast. Operators have been quick to dub this new area "Cardium Alley" due to its 30-mile length and narrow width. The trend encompasses Westcott, Carstairs, South Westcott, Crossfield, and Beddington fields. Reservoir characteristics are very similar along the trend, indicating a possible oil field of major proportions.

Cardium Alley has seen a well-developed gas program since the Olds discovery a few years ago. There was scattered drilling in the alley that tapped such fields as Crossfield and Carstairs, gas producers. But the oil play didn't begin until Cree Oil of Canada, Ltd., et al. found production in the Cardium sand at South Westcott last December.

This discovery, drilled on LSD 6, 2-30-3w5, was extended immediately onto LSD 16, 9-30-3w5. Canadian American Royalties et al. then moved the field to the southeast and the rush was on. A trend began to develop between South Westcott pool and the Cardium discovery by Shell Oil Co. of Canada at Crossfield. Three recent events put the alley in business as one of the most closly watched drilling sprees of any past Alberta summer season.

1. Bailey Selburn Oil & Gas Co., Ltd., discovered Cardium oil between the Cree and Shell discoveries to indicate a possible linkup between the two areas.

2. Bailey Selburn et al. have an indicated Cardium oil strike at the key well, 8-13 South Westcott, 1⅜ miles northwest of the northernmost producer at Crossfield, and 1⅝ miles southeast of the south end of South Westcott field. Lower Cardium sand was topped at 6,607 ft. When this well is finished the two fields will be one. Operators then must eye the wider potential area lying between Shell's Crossfield well and the Beddington discovery near the gates of Calgary.

3. The July 26 Alberta land sale added more than $7,000,000 to provincial coffers. Swan Hills brought its usual top bidding, while land on the "Alley" saw $171,687.08 paid out in bonuses. French Petroleum Co. bought Balzac and Crossfield Nos. 1746 and 1747 for $78.80 and $128.56 per acre, respectively. The first of two Dogpound area tracts, No. 1752, was bought by French, and No. 1753 by Canadian Oil Companies, Ltd., and Security Freehold Petroleums for $201.76 and $10.74 per acre, respectively.

Along unusual lines. Note that the parcels taken on the alley are offset by wells that should have had sufficient time to evaluate the Cardium sand, mainly between South Westcott and the newly opened Baysel-Crossfield pool.

The parcel that brought only $10.74 per acre was one of the lowest at the sale. Its position on the east side of South Westcott suggests "land's end" for the Cardium pinchout. There were two noteworthy land rejections by the Alberta Government along the trend where operators failed to bid high enough. The southernmost "no sale" bit of land is just north of the south anchor of the alley, while the other one is clinging to the southeast end of South Westcott pool.

There should be a scramble for these pieces of land at the next sale. The acreage that got $201.76 per acre illustrates its worth by its location in what is probably a no-gamble area. The chunk of land that got $78.80 per acre is in the middle of the 12-mile stretch between Crossfield and Beddington that is yet to be proven a part of the alley. When winter returns to Alberta many questions will have been answered.

THE SHOOTING BOAT moves away after a shot is fired by a marine geophysical crew off the south coast of Dorset and the southwest coast of the Isle of Wight.

British oil hunt moves offshore

THE SHOOTER is at his controls in a motorized fishing vessel used by the British Petroleum Co. seismic expedition.

LATE LAST AUTUMN exploration for oil in the British Isles moved off the southwestern coast of the Isle of Wight. This marine seismic survey took a look at the underwater portion of a large anticline that extends into the sea from the island.

The results of this marine study will determine whether or not British Petroleum Co. will drill this anticline which has long been thought oil bearing.

This marine operation is part of an active British Petroleum Co. exploratory program in the British Isles that has been going on for the past 25 years. This long search for oil in the United Kingdom led to the discovery of the producing fields in England's Midlands.

Third hunt. This marine seismic survey was the third to be undertaken

Photos and information courtesy British Petroleum Co., Ltd., Magazine.

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production–
refining–
transportation–
marketing–

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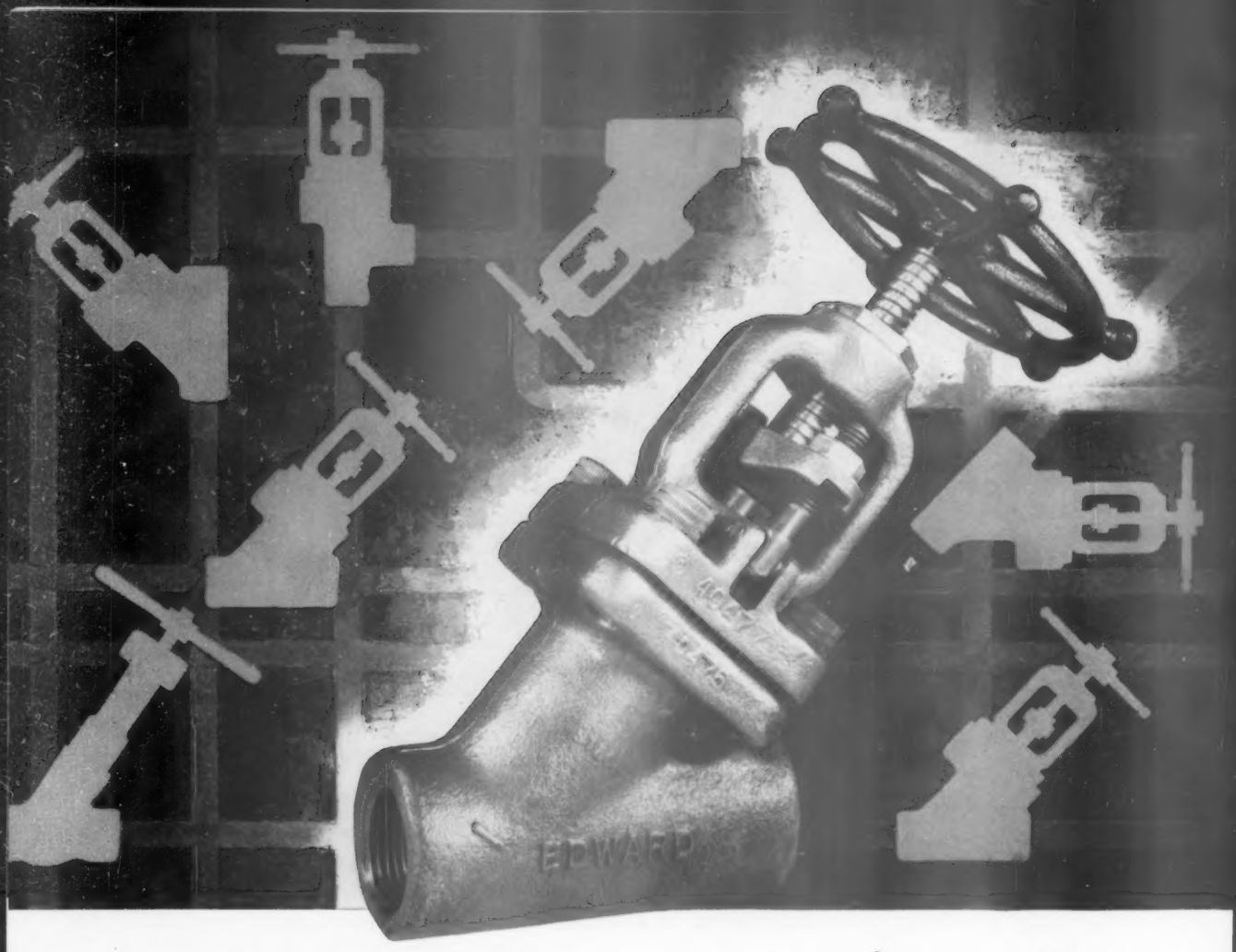

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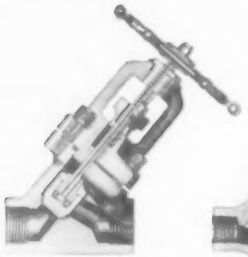
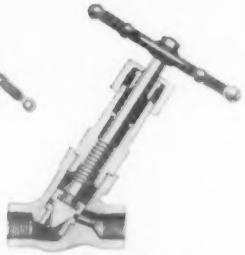


General Purpose Globe Valve
Fig. 848, Bolted Bonnet
2000 lb WOG
600 lb at 910F
(Sizes ¼" to 1")



High Pressure Globe Valve
Fig. 158, Screwed Bonnet
10,000 lb WOG
(Sizes ¼" to 2")

Fig. 848 features new spiral wound gasket, new solid disk of chrome-cobalt-tungsten alloy, integral Stellite seat, forged steel body and bonnet, exclusive EValloy 13% chromium stainless steel stem, and new swing-style stainless steel gland bolts. Also available in angle design. Fig. 158 features EValized bonnet to resist corrosion and abrasion, and protect stem threads; replaceable screwed-in seat and swivel needle disk of EValloy 13% chromium stainless steel, Impactor* handle, Buna-N "O" rings for leakproof joints. Both valve types are available in choice of screwed or socket welding ends.

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"Many weeks of rough seas made the seismic task seem impossible."

on behalf of BP in the country by Seismograph Service, Ltd. The first two such surveys were in 1956. A specially converted corvett of 1,100 tons was used for the work in Robin Hood's Bay off the Yorkshire coast and later in Dorset waters, off Swanage and Lulworth Cove.

The Isle of Wight survey used two smaller boats, primarily to enable the survey lines to be taken closer into shore. Necessary instruments were installed in a motorized fishing boat.

Close cooperation. In this series of operations there was a high order of cooperation between the geophysical team, led by Idris Bourner, a former member of BP, and the owner and skipper of the ship. The skipper has more than 42 years experience in coastal waters of the British Isles. Bourner is an old hand with years of experience in seismic work in the Middle East and Europe, and in African rivers. The navigator was an ex-regular soldier. Another member of the team was a science teacher in the London school system.

Lobster season. The lobster season off the Isle of Wight delayed the seismic operation until fall when weather and mounting seas hindered work considerably. Many weeks of rough seas made the seismic task at times impossible.

After completion of the Isle of Wight operation, BP moved its marine survey into southern England's Kimmeridge Bay . . . part of the Paris basin. The company ran a survey here in 1956 with the 1,100-ton boat mentioned before. The smaller boats aided taking the study closer into shore. This survey is being undertaken to determine the seaward extent and size of the anticline on this part of the Dorset Coast. There is already production in this area of England which may well be of commercial scale with further development. This is also the first indication of Jurassic oil in England. BP will also make a marine seismic survey off the Ringstead coast in Dorset.

THE NAVIGATOR, an ex-regular in the Royal Artillery, takes a sextant reading in waters off the English Coast.

THE CREW pays out cable from the motor fishing vessel at the beginning of the firing line.

NORTH, SOUTH, EAST AND WEST—

OPERATORS GET FAST PAYOUTS, GOOD PROFITS

You increase net profits when you perform successful workovers on your wells. Dowell services, products and engineering aids are designed to help you get those added profits. Here are results from a few of many recent jobs.

OPERATOR NETS $4715 IN 90 DAYS FROM ABRASIJET AND ACIDIZING BY DOWELL

ALBERTA, CANADA. Three old wells in the Redwater pool produced an *extra* 4520 barrels of oil in 90 days as a result of Abrasijet*—Dowell's abrasive jetting service—and Dowell acidizing treatments. After deducting total workover and treatment costs from added revenue of $10,115, a net profit of $4715 was realized.

DOWELL SAVES GAS WELL— GETS 10-DAY PAYOUT

SOUTH TEXAS. A Dowell frac job made a 2,750 mcfd producer out of an old Frio well that was practically dead and non-commercial. Payout on treatment was estimated at 10 days.

DOWELL FRAC JOB BRINGS NEW LIFE TO 40-YEAR-OLD GAS WELL

WEST VIRGINIA. 850 mcfd open flow and 200 mcfd delivered into line resulted when Dowell fractured a practically dead 40-year-old gas well. Treatment cost was paid out in less than 30 days.

TREATMENTS WITH VERSENE 100 GIVE 35-DAY PAYOUTS IN PERMIAN BASIN

WEST TEXAS. Average payout of ten treatments by Dowell using Versene® 100 was 35 days. Versene 100 is a chemical used to remove calcium sulfate, calcium carbonate and other scales from wells. Average production increase was 9.7 bopd and treatment costs were between $550 and $875. Net value of oil was assumed to be $2.00 per barrel.

WITH DOWELL WORKOVER TREATMENTS

DOWELL USES "ACID GUIDE"* TO GET FAST PAYOUT ON THREE PROBLEM WELLS

NORTH DAKOTA. Payouts of 55, 23 and 65 days were realized from treatments with Retarded Acid of three old wells in the Madison lime of McKenzie County. Previous treatments using regular acid in the same field had failed to pay out.

NEW ACID TREATMENT SAVES OPERATOR ABOUT $400 PER MONTH ON WATER DISPOSAL WELL

SOUTHEASTERN NEW MEXICO. A single $735 treatment replaced three $650 monthly treatments on a Lea County disposal well. By substituting Stabilized Acid and a surfactant wash for regular acid, life of the job was tripled at an extra cost of only $85. Savings averaged about $400 per month.

FRAC JOB PROVIDES EXTRA GAS AT THREE CENTS PER THOUSAND

NORTH LOUISIANA. 105 mmcf of *extra* gas was produced in four years from a well in the Monroe Gas Field. Reason for this extra production was a Dowell frac job performed in March, 1956. Based on treatment price, the extra gas cost the operator three cents per thousand. 39 similar wells fractured early this year promise to be at least as profitable as the 1956 job.

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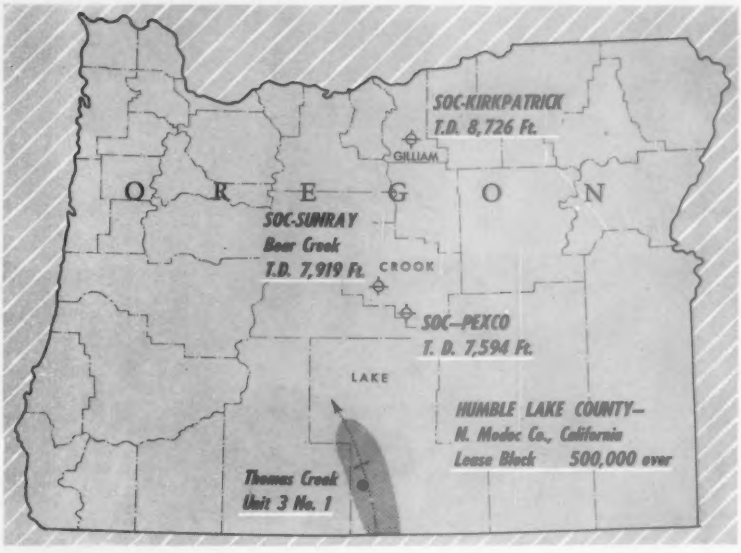

SOUTHERN OREGON'S huge Thomas Creek structure is being drilled by Humble Oil & Refining Co.

Humble spuds important Oregon wildcat

IN OREGON Humble Oil & Refining Co. recently spudded 1 Thomas Creek, 18-36s-18e, Lake County. The well falls approximately 22 miles northwest of Lakeview, and is the first of a reported two-three deep well program aimed at pre-Tertiary strata in South Central Oregon.

Huge structure. The test is located on a huge surface anticline which extends northwest-southeast for a distance of at least 60 miles in Oregon alone. Its southeast extension into Modoc County, California, is unknown but presumably extends for a considerable distance where it is covered by a reported 150,000 acres of Humble leases. The anticline is developed in Miocene and Pliocene pyroclastics and lavas of the Columbia-Modoc plateau. Objectives for the 12,000-ft. test have been announced by Humble as prelava and presumably are Mesozoic and possibly upper Paleozoic similar to strata exposed in the Central Oregon uplift to the north near Supplee, Ore., and in northern California.

Humble commenced leasing activity in the area in the spring of 1959 and reportedly has assembled a block of some 500,000 acres including the Modoc County, California, acreage. The block includes principally federal and state lands with some large privately owned ranch lands.

Prelava renewal. The Humble test represents renewed activity in central Oregon for prelava objectives. Standard Oil Co. of California drilled three deep dry holes, one of which was a farmout to Sunray Mid-Continent, north of the Humble block between 1955 and 1958 within a block of some 200,000 acres. While marine Cretaceous strata were reportedly penetrated in two of the wells no important shows or permeable reservoir objectives were encountered. Standard is currently quitclaiming acreage within this block.

The test will be closely followed by the oil industry and is regarded as a highly important wildcat.

Alberta has encouraging strike

THE MOST encouraging oil strike in southeastern Alberta for some time was uncovered recently by a group of American associates headed by Spelman Prentice of Tarrytown, N. Y.

Drilling on lands acquired under farmout agreement from the California Standard Co., the team rated an oil flow from the Sunburst sand during a drill-stem test. Discovery horizon was the Sunburst sand, a member of the Manville group of Lower Cretaceous. Although not officially reported it is understood that a pay sector of 25 to 30 ft. was encountered.

The new find is situated in the general Bantry-Tilley district, 70 miles northeast of Lethbridge and 120 miles southeast of Calgary. The closest previous production is in the Bantry field 7 miles northwest. That field was discovered in January 1948 by California Standard Co. and the well flowed 151 bbl. of 23°-gravity oil per day during potential test. Since that time another 25 wells have been successfully completed in the field but exploration in the area was sporadic.

Pay was contacted at 3,170 ft. and drill-stem test covered only the top 12 ft. However, oil flowed to the surface in 25 minutes and was allowed to do so for another 5 minutes. Rate was not calculated but when pipe was pulled fluid unloaded from the pipe and a final recovery of 2,000 ft. of clean oil plus 15 ft. of filtrate was made. Flow pressure, meanwhile, built up from 688 lb. initially to 989 lb. at final reading. Shut-in pressure was a steady 1,590 lb.

Following the drill-stem test the hole was drilled into the Mississippian formation and casing set. Battery and tanks are currently being installed on the lease after which production testing will get under way.

Good record. Spelman Prentice & Associates have an impressive record going for them in Canada as this is their second exploratory test and as many discoveries have resulted. The initial discovery hole was drilled in Saskatchewan when the group first entered the western Canadian oil and gas scene. That well was the "key" as after developing another 17 producers in Saskatchewan the group switched activity to Alberta with resultant discovery.

Development in Alberta will now take place around this hole if production tests warrant as a total of eight sections were included in the farmout from Cal Standard. On the next ones, however, the group will only have to foot half the bill as Cal Standard retained the other half interest. The initial well was drilled and paid for by the Prensett group.

Spelman Prentice & Associates' land, engineering, and exploration in Canada is being handled by the Calgary-based consultant, D. L. Halverson.

July sees seven new fields for Alberta

Seven new oil and gas fields were opened in western Canada's Alberta, Saskatchewan, and British Columbia provinces during July.

A new oil field was tapped by Banff-CPOG et al. at 15-21-40-1 Hayter on LSD 15, 21-40-1w4. Basal quartz was topped at 2,536 ft. Operations have been suspended at this indicated discovery.

At Brown Creek, Triad et al. 6-20-44-17 Brown Creek, LSD 6, 20-44-

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17w5, flowed gas from the Mississippian Rundlge formation at the daily rate of 4,800 M.c.f.d. through various chokes. Perforations were between 10,718 and 10,816 ft. From the second Rundle at 10,928-11,004 ft. the well flowed 2,250 M.c.f.d. Location is in the prolific Foothills belt.

At Enchant, Omega 7-7-14-17 Enchant, LSD 7, 6-14-17w4, flowed 2 M.M.c.f.d. through ½-in. choke from first Bow Island sand at 2,524-54 ft. From second Bow Island sand it flowed 5,300 M.c.f.d. through ½-in. choke from 2,640-70 ft. The Blairmore at 2,910-80 ft. was good for 1,200 M.c.f.d. through ½-in. choke.

In the Hussar area, CPOG 10 24-28-22 Gatine, LSD 10, 24-28-22w4, flowed 887 M.c.f.d. from Belly River at 2,290-2,347 ft. The 10-13-27-21 Hussar, another CPOG discovery on LSD 10, 13-27-21w4, flowed 2,500 M.c.f.d. from Viking sand at 3,811-61 ft. From Glauconitic it flowed 5,780 M.c.f.d. from 4,416-46 ft.

British Columbia. At Deer Lake Pan American Petroleum Corp. A-1 Deer Lake a-90-1, at a-90-I-94-O-6, flowed 22 M.M.c.f.d. from Slave Point Devonian porosity zone topped at 9,670 ft. Perforations were at 9,705-25 ft.

Saskatchewan. In the Hastings area McBride Alcon 16-21 South Hastings, LSD 16, 21-3-33w1, is a Mission Canyon Mississippian oil discovery at 3,913-42 ft.

To date. So far this year there have been 64 new oil and gas strikes in western Canada, compared to 71 in the same period last year. Alberta has had 19 new oil discoveries and 25 gas pool finds. Saskatchewan has had 4 new oil fields opened, British Columbia 1 oil and 11 gas discoveries, Northwest Territories 1 new gas field at Celibita Lake.

Lake Erie strike is successful

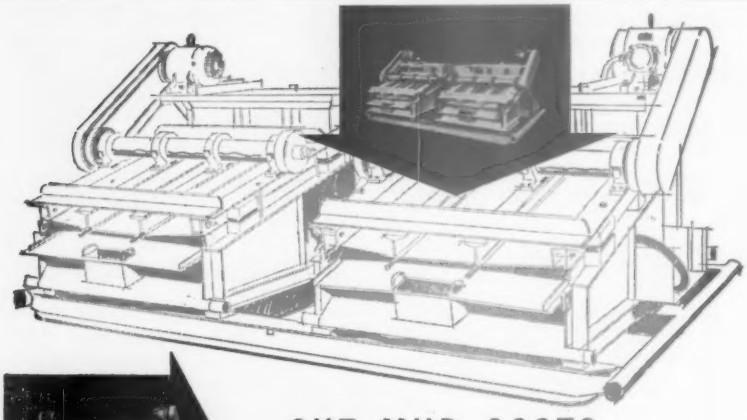
SUCCESSFUL DRILLING of the Place Gas & Oil Co., Ltd., 4 Colchester well, 1,600 ft. offshore from Colchester oil field in Ontario's Lake Erie, is reported. The well was drilled by cable tools to top of the Trenton Ordovician, and completed through the pay by diamond coring, using mud to completely contain the oil in the well to avoid spillage into lake waters. Production casing was run and final production figures are expected soon.

The 1 Colchester, first successful oil well drilled offshore last year, is now on production. This well was connected to the tank battery onshore last June. An acid treatment through the gather pipelines from shore was completed recently with excellent results. Initial production was 248 bbl. of oil in 9 hours after acid return. The highest production attained 3 days later was 562 bbl. in 24 hours. This well is free flowing and is expected to level off between 200 and 300 bbl. daily. Production is being shipped to Imperial Oil Co.'s refineries at Sarnia at a wellhead price of $3.15 per bbl.

Rig to move. Upon completion of the No. 4 well, drilling equipment will move to a new location for drilling No. 5 Colchester, a 1,000-ft. offset.

Production in Colchester field is from Trenton at about 2,200 ft. The pay appears to be similar to that in Scipio trend, southern Michigan.

Gas news. In addition to oil development, Place reports the successful completion of 21 Walpole gas well with an open flow of 534 M.c.f.d. Production was at 900 ft. in the Red Medina sand. In this eastern sector of Lake Erie, offshore from Walpole Township, Place has had excellent results with completion of four gas wells this year, providing a total additional open flow of over 2,600 M.c.f.d.



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Gathering lines have already been tied into two of these wells, and the others are in process of being connected to the gathering system.

Results of the current drilling program, added to last year's developments, gives Place 15 commercial gas wells available for delivery of gas to the Union Gas Co. distributing system. The current price received by Place for this gas is 45 cents per thousand cubic feet. The increased rock pressures obtained in the wells drilled last year as the development proceeds farther out into the lake, now allows a revision of estimates of recoverable gas reserves. The latest estimate is about 2½ billion cubic feet of gas per square mile.

Ontario drilling sets fast pace

Summer development drilling in Ontario is brisk.

Port Dover Gas & Oil Co., which spudded its first Trenton Ordovician test at 1 Dover-Baska last month, is drilling below 1,100 ft. This well is inside Dover oil and gas field. A well 500 ft. away has been a gas producer for more than 30 years.

At Princeton. Robert McMaster & Sons have completed the second successful oil well at Gobles, west of Paris in Oxford County, Ontario.

The second Cambrian producer is free of gas which accompanied the first well and which delayed maximum oil production.

In Mosa. Anchor Petroleums, Ltd., will drill another gas well on proven location at North Wardsville field in Mosa Township. Well site is on the south ¼ of Lot 12 in Concession 1, on the M. and A. Reycraft farm. It is the offset to the 19 well which was drilled successfully earlier this year. Gas production is at about 1,500 ft.

Well completed in Kentucky's Pike County

In Big Sandy gas field, Pike County sector, Ashland Oil & Refining Co. has completed 1 Bob's Branch unit for 530 M.c.f.d. of gas. Producing horizon is the Devonian black shale topped at 2,580 ft. Well is bottomed at 3,505 ft. and was shot with 10,400 lb. of gelatin.

Michigan's Hillsdale has Trenton show

IN MICHIGAN, Hanners Oil Co. 1 Sterling, SW SE NW 24-5s-2w, Hillsdale County wildcat, located 7 miles east of the Scipio-Albion trend, logged

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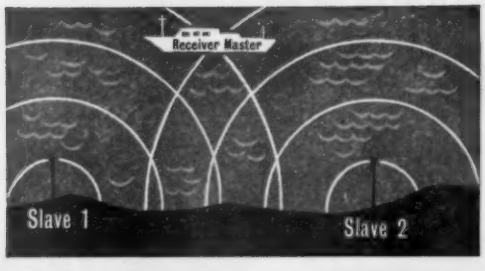

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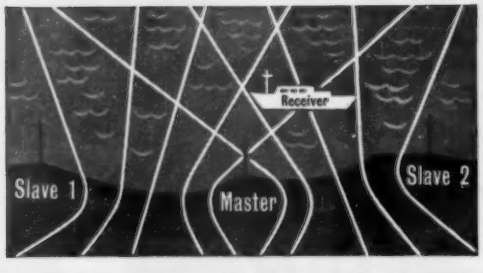

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Trenton at 3,653 ft. and Black River at 3,983 ft. with 10,000-ft. gas and good show oil in dolomite at 4,185-93 ft. Deepened to 4,336 ft. no additional pays had been logged.

The "off trend" show excited the Michigan industry, which up to now in 18 months of active exploration has been unsuccessful in finding Trenton-Black River oil production off the Scipio-Albion trend.

● Panhandle Eastern Pipe Line Co. 0-2 Lindke, NW SW SE 22-4n-15e, located on the southeast side of the Peters-Casco pool, flowed 65 bbl. oil on 1-hour test at 2,622-35 ft. from Niagaran.

Clinton probes successful in Ohio's Hocking

Successes are the rule in oil prospecting in the Clinton play north of Logan, Ohio.

Four more wells were added to the pool in Section 36, southeast Marion Township, Hocking County. Emme Oil Co.'s 1 Bessie Frantz, finaled at 116 barrels oil per day and its 1 Frank Fickle, 60 barrels oil per day with 73 M.c.f.d. after treatment. The sand was logged at 2,740-70 ft. and 2,743-73 ft. respectively. Dave Collins 3 Andrew J. Inboden, tested 50 barrels oil per day after fracture from the sand at 2,669-93 ft. Natol Corporation 1 J. G. Coakley, made 40 barrels oil per day with 30 M.c.f.d. after fracture. The Clinton sand was logged at 2,676-2,715 ft.

Oxford Oil Co. moved across the township line to Falls Gore Township, and completed 1 C. B. Hammond, Section 30, as an extension to this pool. The Clinton was found at 2,768-95 ft. and gaged 40 barrels oil per day with 40 M.c.f.d. 2 weeks after fracture.

The 30 completions to date in this development average 51 barrels oil per day and no failures.

Sooners hit pay all over state

EXPLORATORY SUCCESS in Oklahoma reigns in every corner of the state.

Important development is reported in Garvin, Major, Coal, Comanche, Woods, Beaver, and Muskogee counties—a wide area encompassing southern, southwestern, northwestern, and eastern Oklahoma.

Cities Service Oil Co. is testing at 1 Brown-K in C SW NE 16-4n-3w, an indicated triple-zone producer for Southeast New Hope field in Garvin County.

Gas-condensate is flowing from McLish and Oil Creek Ordovician sands. From McLish at 9,402-35 ft. the well flowed 93 bbl. condensate in 21 hours through ¼-in. choke in 21 hours with 2,960 M.c.f.d. Tubing pressure was 3,050 psi. flowing and 3,250 psi. shut in. The Oil Creek flowed 70 bbl. condensate in 9 hours through 15/64-in. choke from perforations at 9,714-58 ft. plus 2,900 M.c.f.d., tubing pressure at 2,800 psi., shut-in pressure are 3,200 psi. The Third Bromide Ordovician sand at 9,266-9,345 ft. is shut in.

Major County. Prolific Cheyenne Valley field in northwestern Oklahoma's Major County picked up another good well at Shell Oil Co. 2-8 Brewer-E in C NW NW 8-21n-14w.

The well completed flowing 220 bbl. of oil per day through 14/64-in. choke. Perforations were in the Cherokee Pennsylvanian sand at 6,992-7,072 ft.

Gas discovery. Pan American Petroleum Corp. opened a gas pool at 1-A Reames in C NW SE 29-20n-11w, north of Blaine County's Northwest Okeene field. The well flowed 7,116 M.c.f.d. from Chester Mississippian at 7,378-90 ft.

Southeast. In Coal County's Cen-

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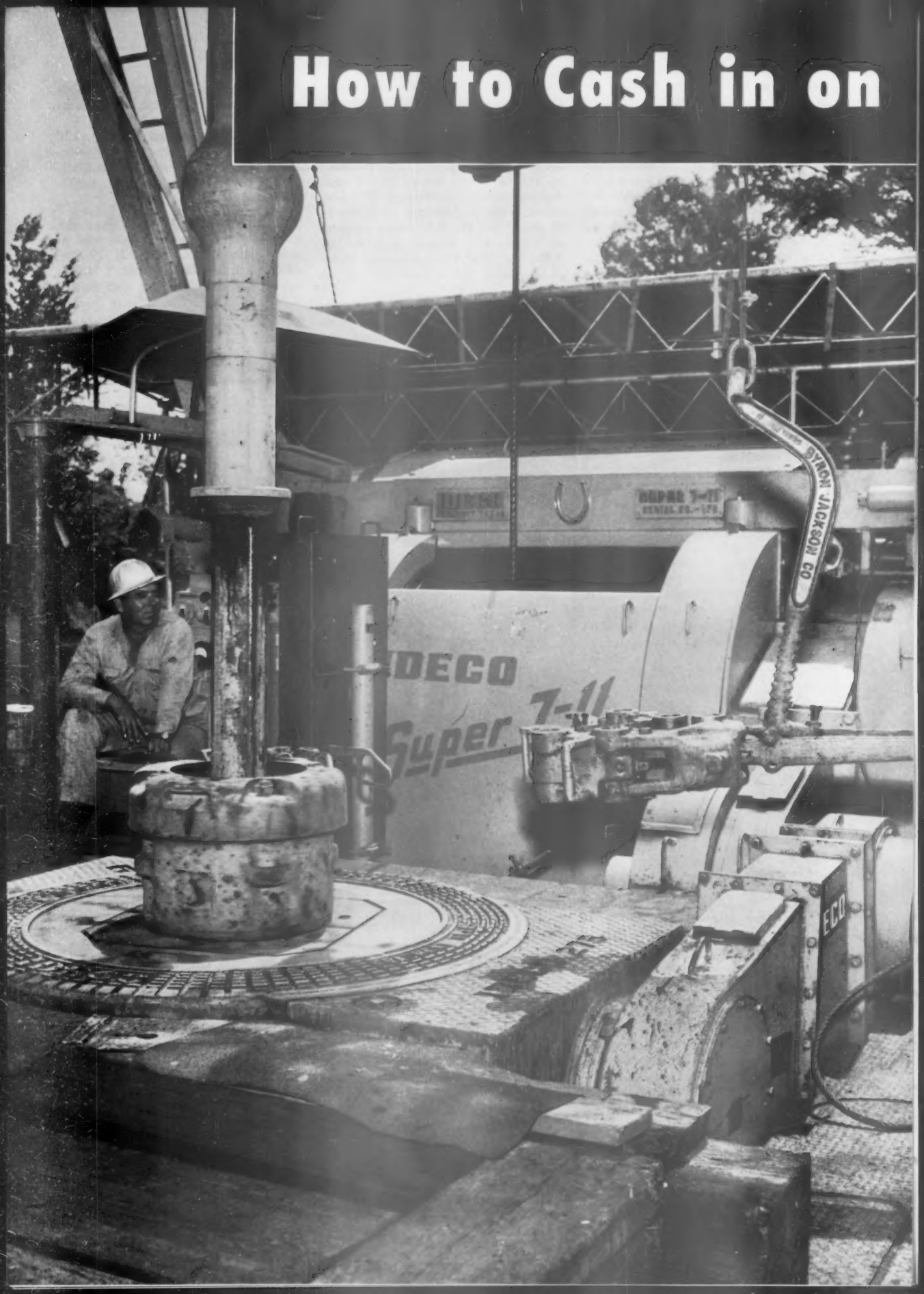

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trahoma area, new Ordovician production may be in the mill at Tennessee Gas Transmission Co. 1 Hudson in NE NW 7-1n-10e. Reports state that the well flowed 40 bbl. of oil per hour during tests of the McLish sand.

Muskogee County has a new gas field at Allied Materials 1 Walker in SE SW NE 18-13n-18e, between Oktaha and Keefeton fields. The well flowed 4,300 M.c.f.d. through 22/64-in. choke from perforations at 1,430 to 1,460 ft. On 1-in. choke it made 4,640 M.c.f.d.

Southwest. Woods Petroleum Co. 1 Wilson in C NE NE 20-3n-9w, Comanche County, is a triple-zone discovery northwest of Southeast Sterling field. The well flowed 5,500 M.c.f.d. from Briscoe at 7,040-53 ft.; 3 M.M.c.f.d. from Yule-Funk at 7,158-62 and 7,169½ to 7,170 ft. From Wade at 7,295 to 7,331 ft. flow was 5 M.M.c.f.d.

Woods County. In northwestern Oklahoma, Myer & Dew 1 Losbough, NE NE SW 7-26n-16w, 6 miles west of Northwest Avard field, flowed 10 M.M.c.f.d. from Tonkawa Pennsylvanian at 4,876-86 ft.

Panhandle. A new Beaver County discovery is Anderson Prichard Oil Corp. 1 Flock in SE SE NW 14-1n-25eCM. The well flowed 554 bbl. of oil per day on 45/64-in. choke from Morrow Pennsylvanian at 7,928-46 ft. From 8,360-78 ft. it flowed 136 bbl. per day on ½-in. choke.

Good Gallup oil found at San Juan basin test

High oil flows from Gallup Cretaceous were reported at a well in Ojo Amarillo field, San Juan County, San Juan basin, northwestern New Mexico.

El Paso Natural Gas Products Co. 4 Ojo Amarillo, C NE SW 27-29n-14w, flowed 400 bbl. of oil daily on 20/64-in. choke from perforations at 5,238-50 ft. This is the fifth well in the new field and is the best gage yet.

Kingfisher leads Oklahoma drilling

ALL SECTIONS of Oklahoma are busy, but Kingfisher County retains its lead over regional interest.

Cabeen Exploration Co. 1 Reiswig in C NE NW 21-19n-7w is the newest discovery of note in this area. The well has both Manning and Meramec Mississippian production. The Manning was good for 2 M.M.c.f.d. at 6,980-7,002 ft.; the Meramec in open hole flowed 2,530 M.c.f.d.

Jones & Pellow Oil Co. have Oswego and Manning oil at the 1 Stinson in C SW NE 9-18n-7w, northwest of North Dover field. The well flowed 80 bbl. per day from Oswego and 100 bbl. per day from Manning. Carter division of Humble Oil & Refining Co. 1 Huntsberger is the second producer and Manning zone discovery for North Hennessey field. The well flowed 18 bbl. condensate per day and 2,130 M.c.f.d. The Mississippi lime flowed 44 M.M.c.f.d. and 17 bbl. condensate in 6 hours through ¼-in. choke. Marion Oil Co. 1 Cooper in C SW SW 1-19n-6w, northeast of East Hennessey field, flowed 78 bbl. in 6 hours from Manning. The Meramec made 223 bbl. in 6 hours through choke.

East Lincoln-Southeast Lincoln field has 21 completions from Oswego. Texaco Inc. is leading this development work. The 1 Bollenback-B in C NW NW 29-17n-5w flowed 378 bbl. of oil per day through ¼-in. choke from open hole at 6,288-6,310 ft.

Calvert Drilling Co. 1 Wrobbel in C SW SE 13-17n-7w, Southeast Dover field well, flowed 197 bbl. of oil per day through 22/64-in. choke from

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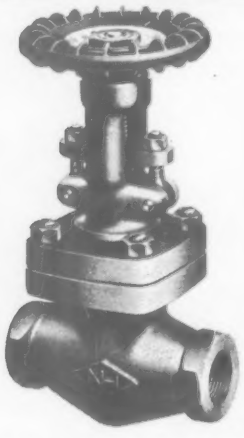

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Oswego at 6,648-68 ft. Tidewater Oil Co. has two wells in Northeast Dunlap field. At North Okarche field, Calvert 1 Schroder in C SE NW 17-15n-7w flowed 5 M.M.c.f.d. through 21/64-in. choke.

Big gas area opened in Texas' Sheffield Channel

Important gas production was officially opened in the Sheffield Channel area of Pecos County, Texas, 5 miles southwest of Sheffield townsite.

Shell Oil Co. and Humble Oil & Refining Co. completed 1 Blackstone-Slaughter in northeastern Pecos County for 11,250 M.c.f.d. Gas-oil ratio was 18,000:1. Perforations are in Ellenburger Cambro-Ordovician at 10,050-60 and 10,082-92 ft. Location is 11 miles southeast of Sheffield field in Section 19, Block A-2, TCRR Survey.

This is the third deep Ellenburger producing area in the vast region between the Delaware and Val Verde basins of far western Texas. Puckett field to the west has 15,000-ft.-plus production in Ellenburger, Sheffield field to the northwest has 9,800-ft. Ellenburger pay, while Brown-Bassett multipay field to the southeast has Ellenburger pay at 11,294 ft.

Nearby shallow production to the north and northeast is from Permian for the most part.

Drilling returns to far-west side of Wyoming's Green River

An important wildcat for the far west side of Wyoming's Green River basin Overthrust belt region will be J. W. Morris 1 Weber in SW NE 15-31n-119w, Lincoln County.

Nearest production is 30 miles northeast at newly opened Mickelson Creek Unit. It has been more than a decade since drilling of any kind has been done in this part of the state.

New Dawson field in Texas adds producer

The third Mississippian in new West Lamesa Mississippian field in Dawson County, 3 miles southwest of Lamesa in West Texas, was brought in last week by Amerada Petroleum Corp.

The 1-A R. C. Moore flowed 540 bbl. of 38.6°-gravity oil daily from ½-in. choke from open hole. This well also flowed 351 bbl. of Spraberry oil through ¾-in. choke at 7,920-63 ft. The field is a dual producer with both Mississippian and Spraberry. Location of the new well is in Section 14, Block 36, T-5-N, T&P Survey.

Panhandle wildcat opens gas production

Significant Morrow Pennsylvanian gas production was opened in a new area of Texas Panhandle's Ochiltree County, 2¼ miles from production and 3 miles west of Parnell field, nearest similar production.

Discovery well is Shamrock Oil & Gas Co. 1 W. L. Herndon, Jr. et al. in Section 490, Block 43, H&TC Survey, 12 miles southeast of Perryton in the southeastern part of the county. Flow was 8,600 M.c.f.d. open with shut-in pressure 4,237 ft. Perforations were at 9,576-90 ft.

Shallow service offered in Calgary

A new service for the petroleum and construction industries has been established in Calgary. Called Soil Surveys and headed by J. N. Gregory, the firm offers an instrument named the DynaMetric Seismic Timer on a sales, rental, or contract service basis.

Objective of this tool is to explore

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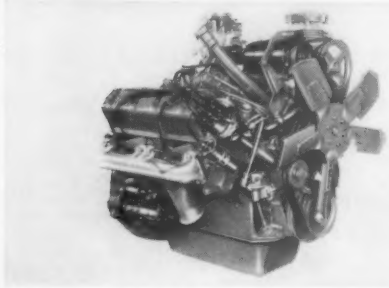

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Louisiana field edges into Texas

South Louisiana's one-well Skinners Lake field, in Beauregard Parish, has been extended ¾ mile northwest across the state line (Sabine River) into Newton County, Texas Gulf Coast, to add to the growing list of Texas and Louisiana two-state fields.

The new extension well is Atlantic Refining Co.'s 5 H. W. Suddeth Fee, dually completed in two Yegua zones. It is 9½ miles southeast of Call, in the Henry Suddeth Survey.

Its lower zone, perforated at 7,708-13 ft., is oil-productive, flowing 120 bbl. daily through ⅛-in. choke under pressure of 1,100 psi. Gravity of the oil is 47.5°.

The upper zone, perforated at 7,287-92 ft., tested gas at the rate of 1,850 M.c.f.d. through 12/64-in. choke. Gas carried some 65°-gravity condensate.

The Louisiana discovery well, drilled by Siboney Petroleum Corp., was completed in January 1959 with oil production from the 7,700-ft. zone. Siboney now is in process of completing its second well in both the 7,700-ft. oil sand and the 7,200-ft. gas-condensate reservoir.

The new Siboney well, located northwest of the discovery producer, flowed 115 bbl. of oil per day through 11/64-in. choke during initial test of perforations at 7,692-7,704 ft. Total fluid carried 8% b.s. and w. Flowing pressure was 1,800 psi. Gas and condensate flow from perforations at 7,275-98 ft. was not gaged.

Mississippi wildcat is completed

A wildcat 2 miles east of the newly opened Knoxo field in southwestern Marion County, Mississippi, has been completed with oil production from a lower Tuscaloosa stringer sand.

The Knoxo discovery well, completed in June, is productive of gas from the deeper Washita-Fredericksburg and Paluxy horizons.

The Washita-Fredericksburg sand was shaled out in the new Tuscaloosa discovery well. The Paluxy sands tested salt water.

Both wells were drilled by Texaco Inc., the Knoxo discovery being car-

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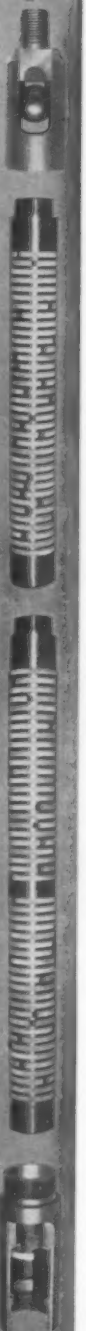

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ried as Texaco-Seaboard, Inc., 1 Board of Supervisors, and the extension discovery as Texaco Inc., 1 Ted Padgett et al.

The Tuscaloosa well flowed 132 bbl. of 35.3°-gravity oil in a 24-hour test through ¼-in. choke. With the oil there was 7½ bbl. of water. Flow pressure was 100 psi.

Discovery Wells

CALIFORNIA

Kern County:

Shell Oil Co. Unit 15, NW NW SW 9-27n-19e, 4,200 M.c.f.d. through 28/64-in. choke, perforations at 2,805-98 ft., TD 3,600 ft. (Discovery well is Shale Flat field.)

Pauley Petroleum, Inc., 1 Bell-Potter, SW NE NE 26-11n-24w, 11 bbl. daily with 1.5% water cut, 25.9° gravity, perforations at 846-908 ft., TD 1,850 ft. (New field discovery in Maricopa South field.)

Solano County:

Standard Oil Co. of California 12 Peter Cook, NE SW 6-4n-3e, 3,850 M.c.f.d. through ⅞-in. choke from perforations at 5,329-31 ft. and 5,441-43 ft. TD 7,730 ft. (Deeper pool discovery in Cache Slough gas field.)

Tehama County:

W. S. Payne, Jr., 2 Hames W. Morgan et al., SE NE NW 8-23n-3w, IP 2,500-4,500 M.c.f.d. restricted flow, producing sand 25-50 ft., TD 4,500 ft. (Shallower pool discovery in Kirkwood field.)

WESTERN CANADA

Alberta:

Cypress 10-30 Hatton, LSD 10, 30-11-28w3. Medicine Hat gas discovery. TD 1,910 ft. Plymouth 6-10 Athabasca, LSD 6, 10-67-22w4. Basal Blairmore gas discovery. TD 2,118 ft. Mic Mac Mayfair 7-17 Medicine Hat, LSD 7, 17-15-4w4. Medicine Hat gas discovery. TD 1,425 ft. 10-5 Medicine Hat, LSD 10, 5-16-4w4. Medicine Hat gas discovery. TD 1,595 ft. CPOG 10-24 Gatine, LSD 10, 24-28-22w4. Belly River gas discovery. TD 5,190 ft.

White Rose 6-21 Westcott, LSD 6, 21-30-3w5. Cardium oil discovery. TD 6,901 ft. Banff-CPOG et al. 15-21 Hayter, LSD 15, 21-40-1w4. Basal Quartz oil discovery. TD 2,696 ft. TGS 6-22 Wildhorse Creek, LSD 6, 22-31-10w5. Mississippian gas discovery. TD 9,085 ft.

Saskatchewan:

Tidewater 6-36 Kenosee Crown, LSD 6, 36-10-3w2. Tilston oil discovery. TD 4,461 ft. 10-10 Parkman, LSD 10, 10-9-33w1. Tilston oil discovery. TD 3,483 ft.

COLORADO

Adams County:

B. F. Allison 1 Dawson-Dinnsen, C NE SE 5-2s-57w. IPF 1,200 M.c.f.d., and 18 BCPD, "J" sand discovery, new field. TD 5,777 ft.

Morgan County:

Richard F. Shaheen 1 Loose, C SW SW 20-5n-59w. IPP 50 BOPD, "D" sand Dakota discovery, new field. TD 6,376 ft. OTD 6,376 ft. OWWO.

Rio Blanco County:

J. H. Page 13-1 Federal, C NW SE 13-2s-102w. IP 224 M.c.f.d., Emery open hole 2,240-2,612 ft. TD 2,675 ft. Emery discovery, new field.

Rio Blanco County, Douglas Pass area:

Utex Exploration Co. 1-A Cathedral, NW NE 20-3s-100w. IPF 1,912 M.c.f.d., Emery 3,499-3,515 ft. TD 6,803 ft. PBTD 3,560 ft. Emery discovery, new field.

INDIANA

Perry County:

O. Greer 1 Winter, SW NW SE 4-6s-3w. IP 1,900 M.c.f.d., Jackson 458-70 ft. TD 470 ft. New St. Marks gas field.

Spencer County:

H. C. Farmer 1 E. Gentry, SW SE NE 33-4s-5w. IP 20 BOPD, Aux Vases 1,040-51 ft. TD 1,051 ft. Opens East Lincoln City field.

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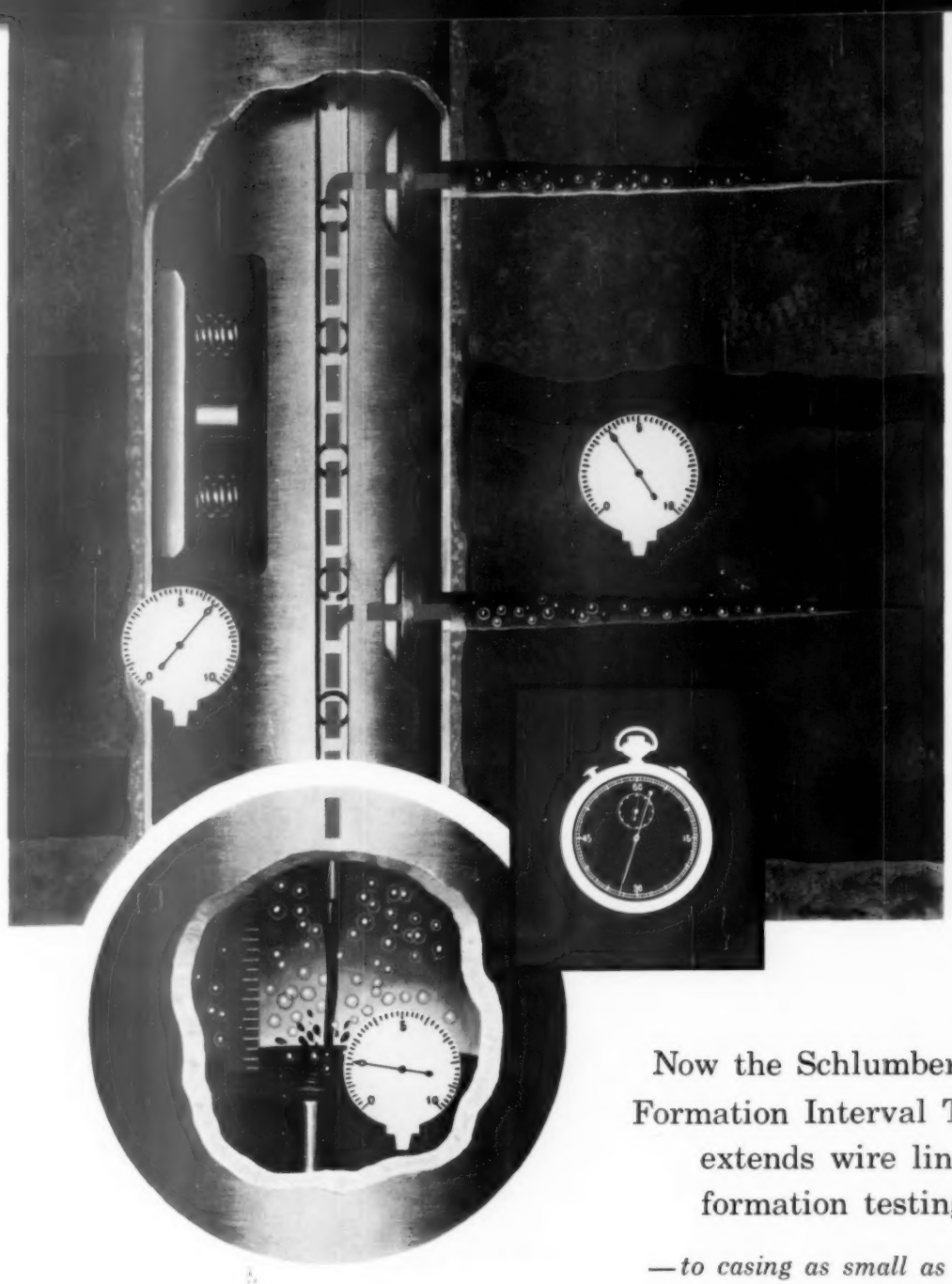

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Northeastern Oklahoma completions, first 7 months, 1960 . . . as reported to Oklahoma Corporation Commission.

The Oil and Gas Journal here presents in tabular form the total number of well completions in northeastern Oklahoma counties for the first 7 months of 1960. These figures represent data turned into the Oklahoma Corporation Commission by operators so far this year. Some of the counties in this old shallow area are not actively scouted by oil-company scouts—Nowata, Rogers, Tulsa, Wagoner, and Washington. Completions in the other counties listed are in addition to those already posted in Journal files. They represent, for the most part, unscouted wells in waterflood projects.

County—	Total	Oil	Gas	Dry	Service	Footage
Creek	44	7	0	0	37	75,836
Hughes	2	2	0	0	0	5,885
Kay	1	0	0	0	1	3,200
Lincoln	3	0	0	0	3	10,911
Nowata	36	10	1	24	1	26,936
Okfuskee	1	0	0	1	0	1,575
Okmulgee	8	3	0	0	5	12,544
Osage	37	5	0	1	31	85,921
Pawnee	5	0	0	0	5	9,054
Pontotoc	10	0	0	0	10	23,019
Pottawatomie	2	0	0	0	2	6,400
Rogers	59	27	0	12	20	39,225
Seminole	2	1	0	0	1	5,220
Tulsa	64	30	1	6	27	88,802
Wagoner	17	3	2	10	2	18,225
Washington	90	55	1	5	29	105,297
Total	*381	143	5	59	174	518,050

*Figures are in addition to wells already reported and posted in Journal files.

KANSAS

Barton County:
- Woodman-Iannitti 1 Marzuis, NE SE NE 4-17s-14w. IP 90 BOPD, 41.5°, Lansing-Kansas City 3,374-78 ft. TD 3,515 ft. Opens Marquis field.
- Peel-Hardman 1 Johnson, NE SE SW 24-18s-14w. IP 11 BOPD, 50% bw., 38°, Lansing-Kansas City 3,301-06 ft. TD 3,414 ft. Opens District 65 field.
- Alpine 1, SE NW NW 29-18s-13w. IP 40 BOPD, 20% bw., 34°, Arbuckle 3,505-19 ft. TD 3,419 ft. Opens West Lake Barton field.
- Chief Drilling Co. 1 Rogers, SE SW SW 1-20s-13w. IP 10 BOPD, 60 BWPD, 39°, Lansing-Kansas City 3,250-3,325 ft. TD 3,451 ft. Opens Southeast Great Bend field.

Butler County:
- Raymond Oil Co. 1 Young, SE SW SE 1-23s-3e. IP 160 BOPD, 40°, Miss. 2,503-28 ft. TD 2,528 ft. Opens Southwest Edmonds field.

Chautauqua County:
- Mesa Petroleum Co. 1 Knowles, SE SE SW 22-32s-9e. IP 10 BOPD, 10 BWPD, Bartlesville 2,130-34 ft. TD 2,288 ft.

Graham County:
- NCRA and Kimbark 1 Ray Rome, C NE SW 27-9s-25w. IP 90 BOPD, 39°, Lansing-Kansas City 4,034-39 ft. TD 4,113 ft. Opens North Emor field.

Kiowa County:
- Northern Natural Gas Producing Co. 1 Fralick, C SW SW 14-27s-20w. IP 50 BOPD, 60% bw. 32°, Miss. 4,843½-44½ ft. TD 5,413 ft. Opens Fralick field.

Marion County:
- Glickman and Houston Petroleum Co. 1 Scully, NW NW NW 18-17s-1e. IP 25 BOPD, 80% bw. 36°, Miss. 2,820-2,900 ft. TD 2,900 ft. Opens Fanska field.
- Francis Hawn 1 Klenda, SE NW NE 11-19s-3e. IP 40 BOPD, 80% bw. Miss. 2,375-2,425 ft. TD 2,425 ft.

Rooks County:
- Davis Brothers-Transit Drilling Co. 1 Eilers "C," NW NW NE 27-10s-18w. IP 158 BOPD, 35°, Lansing-Kansas City 3,460-3,514 ft., Simpson 3,604-14, Arbuckle 3,624-30 ft. TD 3,630 ft.

Stevens County:
- Republic Natural Gas Co. 1 B. Carpenter "M," C SE NW 26-33s-37w. IP 800 M.c.f.d., Morrow 6,142-56 ft. TD 6,663 ft. New gas field.

Sumner County:
- Beardmore Drilling Co. 1 Blesley, NW NE NE 13-31s-2w. IP 46 BOPD, 40% bw. Miss. 3,761-70 ft. TD 3,770 ft.

KENTUCKY

Webster County:
- George Hoffman 1 Valerie Crow, 12-M-23. OWWO. IP 8 BOPD, Penn. 1,594-1,610 ft. TD 2,758 ft. Opens Ortiz pool.

NORTH LOUISIANA

Catahoula Parish:
- William White, Inc., 1-A Louisiana Delta, NE NE NE 11-5n-5e, 1¼ miles north of Larto Lake field. IPP 70 BOPD, 37.6°, perf. 4,935-37 ft., Wilcox. TD 5,849 ft. New field.

MISSISSIPPI

Franklin County:
- Larco Drilling Co. 1-F U.S.A., SE SE 36-5n-3e. IPP 50 BOPD, 37°, perf. 10,940-52 ft., lower Tuscaloosa. TD 11,158 ft. Elev. 311 ft., lower Tuscaloosa 10,910 ft. Discovery well of West Bude field.

MISSOURI

Holt County:
- Wm. Gruenerwald 1 Currie, C NE NE 21-63n-40w. IP 44 BOPD, 64 BWPD, 29.9°, Viola 2,971-75 ft. TD 3,214 ft. New oil field.

MONTANA

Pondera County, South Cut Bank area:
- Miles Jackson et al. 1-A Tribal, SE SE 3-31n-6w. IPP 90 BOPD, 29°, Cut Bank discovery, new field. TD 3,282 ft. Cut Bank 3,062-75 ft.

NEBRASKA

Banner County:
- Great Western Oil Co. 1 Olson, OWWO, OTD 6,798 ft. IPP 10-20 BOPD, "D" sand discovery, new field. TD 6,798 ft. C NE SE 6-17n-56w.

Cheyenne County:
- Texota Oil Co. 1 Reimers, C SW SW 2-16n-50w. IP swabbed 336 BOPD, "J" sand discovery, new field. TD 4,865 ft.

Kimball County:
- Clayton Oil Co. et al. 1 Young, C NW SE 7-15n-55w. IPP 260 BOPD, "J" sand Dakota discovery, new field. TD 6,505 ft.

NEW MEXICO

Chaves County:
- N. G. Peters Drilling Co. 1 Allen & Wagner-Cannon, 6 miles northeast of Roswell in 17-10s-25e. IPF 48 BOPD, ½-in. choke, 27°, TP 50 psi., CP 150 psi., Permian 763-99 ft. TD 801 ft. New oil discovery.

Lea County:
- Shell Oil Co. 1-36 State "B," 4 miles northwest of Jal in 36-24s-36e. IPCAOF 61,500 M.c.f.d., 34.5 BD, 57°, Ellenburger 12,730-12,890 ft. TD 12,966 ft. PBTD 12,926 ft. New gas-condensate discovery.
- Wm. A. and Edward R. Hudson 2-18 Federal, 20 miles southwest of Monument in 18-19s-33e. IPF 229 BOPD, 22/64-in. choke, 30°, TP 750 psi. CP 460 psi. Yates 3,247-56 ft. TD 3,280 ft. PBTD 3,270 ft. New oil discovery.
- Max Pray 1 Zealan L. Crai, 1 mile southwest of Gladiola in 27-12s-37e. IPF 432 BOPD, 9/64-in. choke, 51°, TP 975 psi. packer. Devonian 12,304-12,309 ft. TD 12,333 ft. PBTD 12,325 ft.

McKinley County:
- Otto Reynolds 1 Belknap, C NE SE 13-19n-6w. IPP 67 BO in 12 hours, 46°, Mancos 2,902-40 ft. TD 3,438 ft. Mancos discovery, new field.

NORTHWEST NEW MEXICO

San Juan County:
- Texaco Inc. 1 Federal-State, SW SE 32-30n-11w. IPF 2,401 M.c.f.d., ¾-in. choke, SITP 2,053 psi., SICP 2,300 psi. Dakota 6,548-6,643 ft. TD 6,880 ft. Dakota discovery, new pool.

OKLAHOMA

Carter County:
- Frankfort Oil Co. 1 Enloe, C NE SW 32-5s-3w. IP 62 BOPD, 32.2°, Chimney Hill 8,742-52, 8,800-16 ft. TD 8,816 ft.

Dewey County:
- Texaco Inc. 1 G. I. Thomas, C SW NE 16-17n-14w. IP 19 BOPD, 84 BWPD, 39°, Morrow 9,574-9,612 ft. TD 9,800 ft.

Ellis County:
- Pan American Petroleum Corp. 1 State "J," NE SW 36-24n-25w. IP 8,164 M.c.f.d., Morrow 8,093-96, 8,192-96 ft. TD 8,532 ft.

Garfield County:
- Texaco Inc. 1 Emma Fuksa, C NW SE 14-20n-7w. IP 26 BOPD, 39°, Manning 6,754-64, 6,771-78 ft. TD 7,061 ft.

Garvin County:
- Mid-America Minerals Inc. 1 Prince, C SW SW 32-1n-2w. IP 150 BOPD, 21.7°, Arbuckle 1,275-1,608 ft. TD 2,759 ft.

Harper County:
- Pan American 5 Gatesby Unit, 5, C SE NW 28-25n-24w. IP 150 BOPD, Morrow 7,318-20, 7,324-26 ft. TD 7,530 ft.
- Stekoll Panhandle Ltd. and Statex Petroleum Co. 1 Weaver, C NE SW 28-27n-

21w. IP 564 BOPD, Marmaton 5,479-5,515 ft.; Sylvan 7,303-10 ft. TD 7,941 ft. Hunton discovery.

Kingfisher County:

Apache Oil Corp. 1 Sander Unit, C NE SW 11-16n-8w. IP 1,500 M.c.f.d., Manning 7,941-53, 7,960-64 ft., 7,968-72 ft. TD 8,084 ft.

Jones & Pellow Oil Co. 1 Gabriel, SW NE 14-19n-6w. IP 258 BOPD, 39.2°, 41°, Manning 6,466-6,503 ft.; Meramec 6,685-6,725 ft. TD 6,725 ft.

Kiowa County:

W. Tom Campbell et al. 1 Fred Burnett, E½ NW SW NE 30-7n-20w. IP 300 M.c.f.d., Dolomite 867-80 ft. TD 1,045 ft. Shut-in gas well.

Logan County:

Ryan Consolidated Petroleum Corp. 1 Wilson, SW NE SE 12-16n-2w. IP 233 M.c.f.d., Cleveland 4,736-42 ft. TD 5,905 ft.

Osage County:

Toto Gas Co. 1 Osage, SW SW SW 5-25n-3e. IP 215 BOPD, 47 BWPD, 39°, Miss. Chat 3,832-54 ft. TD 3,854 ft.

Sequoyah County:

Stephens Production Co. 2 Redland Ranch Unit, SE SW SW NE 23-10n-25e. IP 350 M.c.f.d., upper Atoka 1,659-2,110 ft. TD 6,253 ft.

Texas County:

Hamilton Brothers 1 B. A. Hicks, C NW SE 13-5n-12eCM. IP 11,900 M.c.f.d., Cherokee 5,423 and 5,432 ft.; Morrow 6,039, 6,047, 6,064 ft. TD 6,482 ft.

Woods County:

Calvert et al. 1 Gardner, SE NW 6-26n-15w. IP 18,337 M.c.f.d., Tonkawa 4,954-58, 4,972-84 ft. TD 4,997 ft.

Calvert 1 Brainerd, SW NE 36-27n-16w. IP 4,694 M.c.f.d., lower Tonkawa 4,981-5,000 ft. TD 5,350 ft.

Woodward County:

Sunray Mid-Continent Oil Co. 1 Reinhardt, C SE NW 16-22n-18w. IP 5 BOPD, 5 BWPD, 27°, Chester 7,476-7,657 ft. TD 7,726 ft.

NORTH TEXAS

Archer County:

Bobby M. Burns 1 Graham, 1 mile east of Conner Mississippian field in W. B. Sweeney Sur. A-397. IPP 116 BOPD, Miss. lime 5,139-45 ft. 11/64-in. choke, 41°, TP 380 psi., GOR 605:1. TD 5,151 ft. New oil discovery in Sugg Graham Mississippian area.

W. A. Lofton 1 Petrex Oil Corp. "Lee," 2 miles west of O'Donohoe Caddo and Ellenburger field in SPRR Sur. 5. IPF 240 BOPD, 8/64-in. choke, Caddo 4,901-11 ft., TP 400 psi., 40°, GOR 700:1. TD 5,198 ft. New oil discovery in Sugg Wanda Caddo field area.

TEXAS GULF COAST

Calhoun County:

Quintana Petroleum Corp. 1 Delmar J. Smith et al., Section 8, Block K, Calhoun County Cattle Co. Subd., Santiago Gonzales Sur., A-19, 2 miles northwest of Port O'Connor. AOF 56 M.M.c.f.d., GLR 910 M.c.f. per bbl., 40.7°, shut-in TP 1,942 psi., perf. 4,614-19 ft., Miocene. TD 5,300 ft. New pay in South Powderhorn field.

Cameron County:

Shell Oil Co. 1 J. W. Luttes, State Tract 654, Laguna Madre, 10 miles east of LaLeona. AOF 24 M.M.c.f.d., trace of condensate, 52.2°, shut-in TP 2,672 psi., perf. 6,694-6,710 ft. and 6,720-28 ft., Miocene. TD 10,520 ft. New-field discovery.

Chambers County:

Sun Oil Co. 1 Sun Fee, T. T. Branch Sur., A-40, 17 miles south of Anahuac. AOF 9,200 M.c.f.d., GLR 9,100 cu. ft. per bbl., 50.8°, shutin TP 8,975 psi., perf. 13,400-24 ft., Frio. TD 13,467 ft. New pay in East Smith Point field.

Karnes County:

Harry T. Bryant Drilling Co. and Glen A. Martin 1 E. L. Wood et al., V. Blanco Grant, A-3, 3½ miles south of Runge. IP 64 BOPD, 7/64-in., 36.5°, GOR 875 cu. ft. per bbl., TP 1,275 psi., perf. 6,598-6,600 ft., Wilcox. TD 7,018 ft. New-field discovery.

Matagorda County:

McCarrick, Gouger & Mitchell 1-B M. E. Vrouch, John Crier League, A-19.8 miles northwest of Bay City. IP 149 BOPD, 10/64-in., 34.8°, GOR 763 cu. ft. per bbl., 500 psi., perf. 6,728-32 ft., Frio. TD 7,300 ft. New pay in Northern Ranch field.

Texaco Inc. 5 A. B. Pierce, H&GN Sur., A-209, 1 mile west of Blessing. IP 171 BOPD, 10/64-in., 43.5°, GOR 906 cu. ft. per bbl., TP 1,100 psi., perf. 7,539-43 ft., Frio, and 233 BOPD, 9/64-in., 40.6°, GOR 915 cu. ft. per bbl., 1,750 psi., perf. 7,790-96 ft., Frio. TD 9,222 ft. New pays in Blessing field.

Newton County:

Southwest Gas Producing Co., Inc., 1 Arthur J. Davis, M. Dailey Sur., A-92, 1 mile southeast of Quicksand Creek field. AOF 1,500 M.c.f.d., GLR 12,677 cu. ft. per bbl., 55.3°, shut-in TP 2,175 psi., perf. 10,866-78 ft., Wilcox. TD 11,404 ft. New-field discovery—West Merryville.

Wharton County:

J. A. Kimmey 1 Anna Shult, Lot 5, J. Hyland Sur., A-626, 16 miles southeast of El Camp. AOF 9,800 M.c.f.d., dry gas, shut-in TP 2,042 psi., perf. 4,614-15½ ft., Massive, and 10,500 M.c.f.d., dry gas, 1,860 psi., perf. 4,316-18 ft., Miocene. TD 4,677 ft. New pays in Blue Basin field.

TEXAS PANHANDLE

Hansford County:

Katex Oil Co. 2 Knutson, OWWO, Sec. 3, Blk. 45 H&TC Sur., 20 miles north of Spearman. IPCAOF 9,500 M.c.f.d., SIP 1,950 psi., Morrow 7,148-58 ft. TD 7,400 ft. New gas discovery.

Ochiltree County:

J. M. Huber Corp. 3 White, Sec. 57, Blk. 13, T&NO Sur. IPCAOF 13,800 M.c.f.d., SIP 2,503 psi., Miss. 8,898-8,937 ft. TD 9,031 ft. New gas discovery in Farnsworth Upper Morrow field.

Shamrock Oil & Gas Corp.-Drilling & Exploration Inc. 1 Henry-Bennett, Sec. 50, Blk. 13, T&NO Sur. IPCAOF 3,200 M.c.f.d., SIP 1,616 psi. Cleveland 6,910-24 ft. TD 9,280 ft. New gas discovery.

Shamrock Oil & Gas Corp. 1 W. L. Herndon, Jr., et al., Sec. 490, Blk 43, H&TC Sur. IPCAOF 8,600 M.c.f.d., SIP 4237 psi., Morrow 9,576-90 ft. TD 9,810 ft. New gas discovery.

Roberts County:

Gulf Oil Corp. 2 Marion Osborne, Sec. 26, Blk. B-1, H&GN Sur. IPCAOF 16 M.M.c.f.d., GOR 23,600:1, SIP 3,130 psi., Granite Wash 9,570-90 ft.: 330 M.M.c.f.d., GOR 26,900:1, SIP 3,100 psi. Penn. conglomerate "R" zone 10,846-75 ft. TD 11,567 ft. New gas dual zone discovery.

WEST TEXAS

Andrews County:

Pan American Petroleum Corp. 5-N David Fasken, 15 miles southeast of Andrews in Sec. 41, Blk. 41, T-1-N, GMMB&A Sur. IPCAOF 2,520 M.c.f.d., 59 BCPD, Devonian 11,050-11,100 ft. TD 13,190 ft. PBTD 11,352 ft. New gas discovery.

Crane County:

Gulf Oil Corp. 1-EH State, Sec. 9, Blk. 30, Univ. Lands Sur. IPP 150 BOPD, plus 13.3% water, 31.9°, GOR 48:1. Clear Fork 6,565-78 ft. TD 12,012 ft. PBTD 6,598 ft. OWPB. New oil discovery.

1 State McElroy unit, 10 miles north of Crane in Sec. 12, Blk. 30, UL Sur. IPF 389 BOPD, plus 14% water, 16/64-in. choke, 38°, GOR 1,439:1, TP 2,075 psi. packer, Devonian 10,650-10,740 ft. TD 12,197 ft. PBTD 10,916 ft. New oil discovery.

Culberson County:

Mobil Oil Co. 1 State-Barrett, 12 miles east of Pine Springs in Sec. 18, Blk. 63, T-2, T&P Sur. IPCAOF 13,500 M.c.f.d., Strawn 5,802-17 and 5,830-45 ft. TD 9,578 ft. PBTD 7,143 ft. New gas discovery.

Garza County:

General American Oil Co. of Texas 1-A Koonsman "63," 8 miles southwest of Justiceburg in Sec. 63, Blk. 6, H&GN Sur. IPF 168 BO in 8 hours through ¼-in. choke, 40.76°, GOR 975:1, TP 860 psi., CP 600 psi., Strawn 7,930-50 ft. TD 8,268 ft. New oil discovery.

Kent County:

Tom B. Medders 1 Bilby Wallace, 5 miles northeast of Clairemont in Sec. 59, Blk. 98, H&TC Sur. IPP 148 BOPD, 9% water, 38°, GOR 200:1. Strawn 6,494-6,500 ft. TD 6,650 ft. New oil discovery.

Pecos County:

Gibbs Drilling Co. 1 Mrs. F. E. Toborg, 10 miles northwest of Iraan, Sec. 539, Blk. 1, Arnold & Barrett Sur. IPP 6 BOPD, plus 75% water, 30°, Permian 1,293-1,330 and 1,334-74 ft. TD 1,374 ft. New oil discovery.

Reeves County, Worsham-Delaware field:

Texas Crude Oil 1-24 Anna Slack, 13 miles east of Pecos in Sec. 24, Blk. 6, H&GN Sur. IPF 125 BOPD, plus 13% water, 24/64-in. choke, 37.3°, GOR 648:1, TP 175 psi., packer. Delaware 4,932-39 ft. TD 4,940 ft. New oil discovery.

UTAH

San Juan County, Lisbon:

Elliott Production Co. 1 Lisbon Valley "C," NE NW 9-30s-24e. IPF 272 BOPD, 16/64-in. choke, 6-hour test, TP 660 psi. Gaged 686 M.c.f.d., 53° gravity, Mississippian 8,767-8,830 ft. TD 9,533 ft. PBTD 9,485 ft. Mississippian discovery, new field.

LEGAL

SALE OF OIL AND GAS MINING LEASES, TRIBAL AND ALLOTED INDIAN LANDS. Department of the Interior Bureau of Indian Affairs, Uintah and Ouray Agency, Fort Duchesne, Utah.

SEALED BIDS will be received until 2:00 P.M. Mountain Standard Time, September 7, 1960, and opened at that time in the office of the Uintah and Ouray Agency, Fort Duchesne, Utah, for the leasing of 940.92 acres of Tribal Indian lands, and 10,428.38 acres of allotted Indian lands, located in Townships 8, 9 and 11 South, Ranges 19, 20, 21 and 22 East, Salt Lake Meridian, Uintah County, Utah, for oil and gas mining purposes. Details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to the Superintendent, Uintah and Ouray Indian Agency, Fort Duchesne, Utah.

▶▶▶ Personals

Dr. Alexander Lewis, Jr., manager of Gulf Oil Corp.'s petrochemicals department, has been elected a vice president. He will continue to direct the company's petrochemical interests. Lewis joined Gulf in 1935. He was named manager of chemical marketing when the chemical department was organized in 1955. He became manager of the petrochemicals department 2 years ago. He will continue to headquarter in Pittsburgh.

W. A. Knarr has joined the technical staff of Esso Research laboratories in Baton Rouge. **N. C. M. Landis, J. N. Beard** and **E. W. Wald** have rejoined the staff after military service.

G. F. Gibbins, superintendent of Continental Oil Co.'s Denver City, Tex., production district, has been named superintendent of the Odessa, Tex., production district. **R. G. Bonds,** staff assistant in the North Texas-Panhandle division, Abilene, has been named district administrative coordinator, Odessa. In Continental's exploration research division, research and development department, **Dr. Milford R. Lee** has been named supervising research geophysicist. **Dr. Charles E. Weaver** has been appointed research group leader, and **William J. Thompson** has been named supervising research geologist.

Irvin C. Staeuble, assistant manager of the Sugar Creek, Mo., refinery of Standard Oil Co. (Ind.), has been promoted to manager there succeeding **P. Craig Livesay. Norman T. Robey,** assistant manager of the company's Whiting, Ind., refinery, has been named manager of the Neodesha, Kans., refinery. He succeeds **John H. Johnsen.** Livesay and Johnsen have been transferred to the manufacturing department general office in Chicago for special assignments. **Jens A. Norgaard,** mechanical division superintendent of the Whiting refinery, has been transferred to Sugar Creek to replace Staeuble. **James N. Roper,** planning and scheduling division superintendent at Whiting, will succeed Robey as assistant manager there. **C. A. Cogan,** assistant manager in the operations division of the Chicago general office, will succeed Roper at Whiting.

Dr. R. H. Lindquist has been named senior research chemist in California Research Corp.'s petroleum process research section.

M. J. Stansbury, Margaret Spoerer and **Alfred A. Hopkins, Jr.,** have formed Intrepid Exploration Co., Inc., Bakersfield, Calif.

John Babb, Delta Exploration Co., has been elected president of the Jackson, Miss., Geophysical Society. Other new officers are **Tom Tillman,** Sun Oil Co., vice president; and **Jim Watson,** Humble Oil & Refining Co., Carter division, secretary-treasurer.

Albin Digby Hunt, partner in Hunt, Ratcliffe, & Gray, Calgary consulting firm, has joined the Canadian Department of Northern Affairs and Natural Resources as head of the oil and gas section in the resources division, northern administrative branch. **Stan Adam Kanik,** formerly geologist with Sohio Petroleum Co. in Regina, Sask., and Pan American Petroleum Corp. in Calgary, has joined the department as petroleum lands evaluation officer.

J. W. McDonald, area geologist for Shell Oil Co. in Los Angeles, has been named eastern division exploration manager. He will headquarter in Pittsburgh. He succeeds **P. W. Fairchild,** who is now on special assignment in the New York head office. McDonald joined Shell as a geologist in 1941. Before his Los Angeles assignment, he had served as division geologist in Wichita Falls, Tex., Colorado division exploration manager, and Denver area geologist.

McDONALD

W. A. (Bob) Roberts, superintendent of Phillips Petroleum Co.'s California production district, has been named superintendent of the central division in Oklahoma City. He succeeds **W. M. Schul,** who has retired. **E. E. Clark,** assistant district superintendent of the North Burbank Unit in Osage County, Oklahoma, will succeed Roberts in California. **L. H. Hoelscher,** district engineer, has been named assistant superintendent of the California district. **M. L. McKee,** area engineer in Bartlesville, Okla., will succeed Clark as assistant superintendent of the North Burbank Unit.

Stephen D. Bechtel, president of Bechtel Corp., has been named 1961 recipient of the John Fritz Medal. The annual engineering award, which recognizes scientific or industrial achievement in the engineering profession, is sponsored by American Society of Civil Engineers, American Institute of Mining, Metallurgical, and Petroleum Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, and American Institute of Chemical Engineers. The award cites Bechtel as a pioneer in the development of the modern construction industry. The medal will be presented during the American Society of Civil Engineers annual meeting in October.

E. P. (Gene) Neal, vice president and Mid-Continent division manager for Kirby Petroleum Co. in Tulsa, is now independent geological consultant in Tulsa. He will continue to maintain Kirby's Tulsa land and geological office.

R. D. Humphreys, maintenance superintendent at the Sarnia, Ont., refinery of Canadian Oil Companies, Ltd., has been appointed manager of the company's new Innisfail, Alta., refinery. **D. W. Gard,** assistant process superintendent in Sarnia, has been named refinery superintendent, Innisfail. Humphreys will be in charge of over-all operations of the new refinery. Gard will be in charge of process and maintenance operations.

Ned Johnson, export sales manager in Continental Oil Co.'s petrochemical department, has been named manager, export sales. **A. P. Scharf,** assistant to the export sales manager, has been named manager, Eastern Hemisphere sales, petrochemical department. Also in the petrochemical department, **E. C. Segundo,** technical sales representative, has been named manager, Latin American sales. **J. F. Pinkman,** director of administrative services, has been named manager, administrative services. **C. J. Stanberry, Jr.,** director of the customer service laboratory, has been promoted to manager of the lab. **D. G. Schreck,** director of white oil and petroleum sales, has been named technical assistant to the manager of that section.

Personals

O. F. Van Beveren, vice president of American Overseas Petroleum, Ltd., has been elected president. He succeeds **G. M. Cunningham,** who has retired. Amoseas is jointly owned by Standard Oil Co. of California and Texaco Inc. Van Beveren has been with California Standard and its affiliates since 1933. He was vice president and director of Standard Oil Co. of California, Western Operations, Inc., before moving to Amoseas.

VAN BEVEREN

Donald C. Simpson, engineer with Shell Pipe Line Corp. in Houston, has been promoted to West Texas division engineer in Midland, Tex.

John Scoville, assistant superintendent of Northern Natural Gas Co.'s gasoline and dehydration plant, Spearman, Tex., has been promoted to compressor station and gasoline plant superintendent in Spearman.

R. D. Cunningham, a supervising engineer for United Gas Pipe Line Co. in Shreveport, La., has been transferred to Houston as industrial salesman for the Houston district. He will be responsible for natural gas sales in the Houston area and along the Texas Gulf Coast to Corpus Christi.

John P. West, oil movements coordinator in the transportation department of Standard Oil Co. (Ohio), has taken over responsibility for scheduling and dispatching in the department. **James F. Mapel,** line supervisor of the Cleveland-Canton area, products pipeline division, has been promoted to right-of-way superintendent for the transportation department. He will be located in Cleveland, headquarters of the department. **Herbert L. Davis,** Lima-Toledo area line supervisor in Fostoria, Ohio, will succeed Mapel. **Leland C. Nonnamaker,** assistant to the Cleveland-Canton area line supervisor, will succeed Davis. In other transportation changes, **Robert C. Rice,** division engineer for the products pipeline division, has been transferred from Fostoria to Cleveland as senior engineer, operations staff. **Albert L. Fillenwarth,** engineer, operations staff, will succeed Rice. **Clyde M. Owen,** safety engineer, has been named tri-state division engineer. **William N. Sorensen** has been named supervisor of the new communications section. **Frank G. Hausman** has been named supervisor, design section. **T. C. Johnson** will continue as construction section supervisor. **Andrew C. Gross** has joined the chief engineer's staff as engineer. **Russell G. Ellis, John A. Horstmeyer,** and **William J. Streeter,** junior engineers, have been promoted to engineer.

Wendell Q. Scott, superintendent of Transcontinental Gas Pipe Line Corp.'s Thibodaux, La., pipeline district, has been named division engineer of pipeline Division 2, Baton Rouge, La. **Otho Lane** has been named division engineer of pipeline Division 3 in Decatur, Ga. **Elbert Hunt,** foreman, will succeed Scott as superintendent in Thibodaux. **Floyd D. McFarland** succeeds Hunt. In the compressor department, **Tommy Spencer** has been named division engineer for compressor Division 3 in Decatur. **Bruce Martin** has been named Division 2 engineer, Baton Rouge, and **Robert M. Detamore** has been named division engineer in Charlottesville, Va., Division 4.

Ernie Young, district exploitation geologist for Tidewater Oil Co. in Kern River, Calif., has been transferred to Tyler, Tex., as district exploration manager. **John Pujol,** district geologist in Bakersfield, Calif., has been named manager of exploration in Midland, Tex.

J. A. Iverson, assistant administrative coordinator for Continental Oil Co.'s North Texas-Panhandle division, Abilene, has been named senior analyst in the southwestern region production headquarters, Fort Worth. **W. A. Lewis III,** staff assistant, regional office, has been promoted to analyst in Fort Worth.

S. P. Blumberg has been promoted to research specialist in the research and development division of Humble Oil & Refining Co.'s Humble division, Baytown, Tex. He is now serving on rotational assignment as head of the control and specification laboratory in the polyolefin plant at Humble's Baytown refinery. **R. B. Bennett** has been promoted to section head in the Baytown research and development division and has been given a rotation assignment as petroleum specialties adviser to the Humble division's manufacturing department manager. **R. N. Houze, J. C. Staton, R. W. White, R. H. Patton,** and **W. H. Starnes** have joined Humble's research and development division in Baytown.

Gordon M. Mace, Jr., vice president of Independent Exploration Co., Houston, has been elected a director.

A. J. Senec, manager of Tidewater Oil Co.'s eastern division economics department, has retired after 42 years with the company.

George Tate, Jr., has been named production superintendent for George A. Hoffman, Henderson, Ky., independent operator.

John Weir, mechanical engineer for El Paso Natural Gas Products Co. in Odessa, Tex., has been promoted to division mechanical engineer. **Ray Garrett,** chemical engineer, has been named division chemical engineer in Midland, and **Mark Foerster,** electrical engineer, has been named division electrical engineer.

D. J. Ewing, district geologist for Pan American Petroleum Corp., will head the company's new Billings, Mont., district office in a move of district headquarters to Billings from Bismarck, N. D. **C. J. Franks,** formerly Bismarck district landman, will be Billings district landman.

George B. McLean has been appointed to the new post of marketing manager, Los Angeles region, for Standard Oil Co. of California, Western Operations, Inc. McLean has been district sales manager in Honolulu for the company since 1958. He joined California Standard's marketing department in 1935.

C. D. Cordry, division exploration coordinator for Gulf Oil Corp. in Fort Worth, has retired. Cordry had been chief zone geologist and division geological supervisor in Fort Worth before being named exploration coordinator in 1954.

Albert H. Zinkand, assistant to Tidewater Oil Co.'s marketing manager, has been appointed manager of the export department. He succeeds **R. S. McLaughlin,** who has retired after 27 years with Tidewater and its subsidiaries.

Norman K. Rector has joined Western Industries, Inc., new Tulsa engineering, construction, and management firm, as chief process engineer. Rector was with Walco Construction & Engineering Co. of Tulsa at one time and has also been an independent consulting engineer in the natural-gasoline field.

James K. Wootan, director of exploration for Signal Oil & Gas Co. since 1956, has been named vice president in charge of exploration. Wootan has been with the company since 1946. **E. Paul Ludman,** treasurer, has been elected a vice president. Ludman came to Signal in the merger with Hancock Oil Co. in 1958. Signal has reduced its board membership from 26 to 14. The board had grown as a result of mergers in the past 2½ years with Hancock, Bankline Oil Co., and Eastern States Petroleum & Chemical Corp.

WOOTAN

Robert F. Dutton has been named manager, engineering office, at Shell Oil Co.'s Wilmington, Calif., refinery. He succeeds **John C. Worden,** who has retired.

Howard B. Shelton, northwestern division manager for Sohio Petroleum Co. in Billings, Mont., has resigned to open offices as petroleum consultant in Houston.

A. C. Tutschulte, executive assistant to Tidewater Oil Co.'s production manager in Los Angeles, has been named assistant coastal district manager in Ventura, Calif.

C. D. Carter has been promoted to export sales manager for Ethyl Corp., a new position. He will continue to be in charge of Far East sales.

F. N. Hanlon, Sydney, Australia, has been named chief Australian geologist for Landa Oil Co., Dallas. Landa holds acreage in Australia's Murray River basin area.

Lionel J. Bourgeois, regional coordinator for Europe in the marketing coordination department of Standard Oil Co. (N. J.), and **Norman T. Saltnes,** Eastern Hemisphere adviser on supply and traffic for Esso Export Corp., have been named regional advisers for Europe, the Mediterranean, and West Africa for Jersey Standard. **Roy B. Carder** has been named assistant regional adviser for this area. Carder had been area contact for marketing coordination in the Mediterranean area. **Isaac Doughten III,** area contact for France, United Kingdom, and the Benelux countries, has been named administrative officer on the European coordination staff. **Karl H. Karlson** has been named assistant administrative officer.

Edwin O. Hook, senior research associate for Standard Oil Co. (Ohio), has been promoted to research supervisor. He will head the company's polymer research group.

Dwight N. Johnson, product manager in Du Pont Co.'s research and development division, polychemicals department, has been named assistant plant manager of the company's Sabine River Works, Orange, Tex.

Robert L. Rist, formerly assistant to the manager of exploration for Monterey Oil Co., has joined Porter Sesnon, San Francisco independent operator, as geologist.

Ed Fritz, geophysicist in Pure Oil Co.'s foreign department with headquarters in Chicago, has been named southern division chief geophysicist. He will headquarter in Houston.

Feisal Mansour Mazidi and **Mahmoud Khalid al-Adasani** have been nominated to be directors of Kuwait Oil Co., Ltd. Mazidi, an economist, and Adasani, a petroleum engineer, are both Kuwaitis. Adasani is a graduate of the University of Southern California.

Charles W. Bohmer, Jr., manager of industrial and consumer sales for Humble Oil & Refining Co.'s Esso Standard division in New York, has been transferred to Humble's Houston headquarters staff as assistant in marketing matters to **D. W. Ramsey, Jr.,** vice president and director for marketing.

▶▶▶ Personals

R. C. McCurdy, president of Shell Chemical Co., has been elected chairman of Manufacturing Chemists' Association.

Richard C. Shea has been named chief process engineer for the Bartlesville, Okla., staff of Cities Service Oil Co.

Frank H. Walker, formerly with Indiana State Geological Survey, has been appointed director of oil and gas conservation in the Kentucky Department of Mines and Minerals. Walker is first to hold the post, which was created by the State's new conservation act.

Jim McGrory, head of the economics and design division at the Bayway refinery of Humble Oil & Refining Co.'s Esso Standard division, Linden, N. J., has been named assistant head of the chemical products department. He succeeds **Burt Clarkson,** who recently was transferred to Baltimore. **Bill Ward** will succeed McGrory in economics and design. **George Demakis** has been named assistant-division head, economics and design. **John Skvarla** will succeed Demakis as group head in short range economics. **Carl Thorsten** has been promoted to senior engineer in the technical department at Bayway. **Mike Stanfield,** engineer in instrument technical service, has moved to chemical technical service as contact engineer.

▶▶▶ Deaths

R. Paul Huggins, 68, retired Gulf Oil Corp. vice president in charge of crude oil and products supply, died August 9 at his home in Houston. Huggins retired from Gulf last year after 38 years with the company. Since that time he has been Houston representative for Permian Oil Co.

Fabian Richard Staley, 64, Tulsa independent chemical engineer, died August 5 in a Tulsa hospital after suffering a stroke. Staley was an associate editor of The Oil and Gas Journal in New York at one time.

John W. Johnson, 59, Mount Pleasant, Mich., independent operator, died August 4.

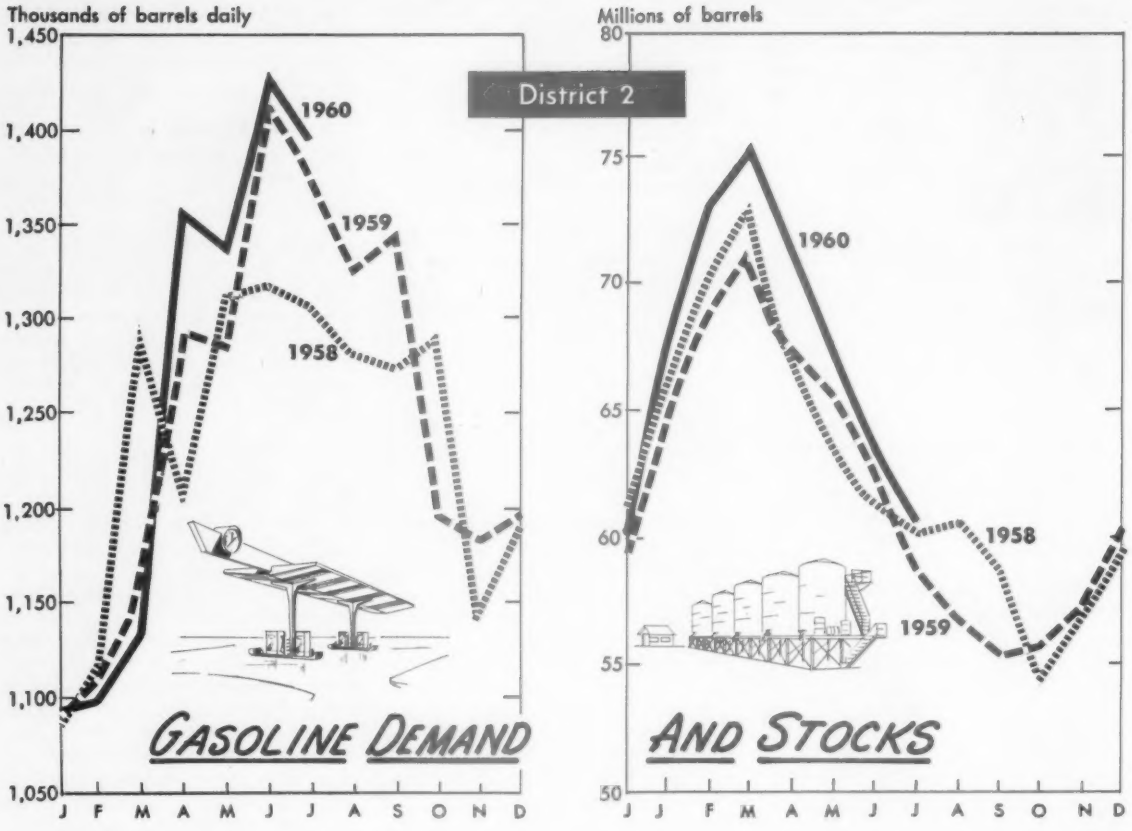
Max B. Schrier, 59, president of Walker Well Heads Co., died August 7 at his home in Tulsa after a heart attack. Schrier also was vice president of Western Reserve Corp., Dallas.

James Stanley Sutton, 51, head of J. S. Sutton & Sons Drilling Co., Wichita, died August 8.

Waldo Basil Sibley, 52, electronics and communications research engineer with Seismograph Service Corp. in Tulsa, died August 5 at his home after a heart attack. He had been with Seismograph Service since 1941.

Leroy Hamilton Williams, 67, former Catoosa, Okla., independent operator, died August 7 in Seattle.

Judge Arthur D. Pope, 81, author of Arkansas' first oil and gas conservation law in 1923, died August 10 in an El Dorado, Ark., hospital.



Demand hikes Group 3 gasoline prices

BY JOHN C. CASPER

FIRMING of the Group 3 gasoline market in recent weeks must be credited to increased demand for the product rather than to any seasonal adjustment in refinery runs.

For a given area, product prices tend to vary directly with demand and inversely with inventory levels. If demand for gasoline increases rapidly, it is normal for prices to move up unless stocks are high. On the other hand, heavy additions to stocks tend to depress prices.

The charts show gasoline demand and gasoline stocks in District 2 for the past 3 years. In the demand chart, points on the line indicate sales of motor fuel produced at District 2 refineries. These are primary sales of District 2 gasoline. No attempt has been made to account for gasoline moving into or out of the district.

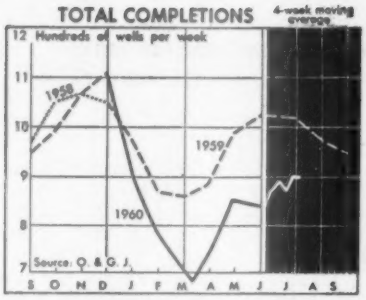
Note that demand in January was about the same as it was in 1958 and 1959. But, sales in February and March were definitely low. Depressed demand by itself would tend to lower prices, but refiners increased the pressure through high production schedules. January production of gasoline set an all-time record for District 2, and output for February showed a gain of 2.5 million barrels over February 1959.

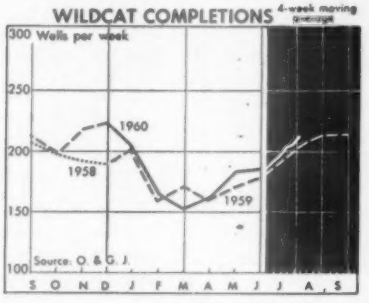
These trends account for low gasoline prices in the first 5 months of the year.

Recovery started with good demand in April. It was blunted a little by the decrease in May but revived under record sales in June and July. Watch gasoline stocks closely in August.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,839,415	UP	11,990	UP	47,455
Crude stocks	244,916,000	DOWN	1,001,000	DOWN	19,816,000
Completions	910	DOWN	27	DOWN	82
Refinery runs	8,271,000	DOWN	19,000	UP	435,000
Gasoline stocks	193,647,000	UP	452,000	UP	10,166,000
Kerosine stocks	30,702,000	UP	905,000	UP	1,698,000
Distillate stocks	134,049,000	UP	5,108,000	DOWN	8,945,000
Residual stocks	43,015,000	DOWN	371,000	DOWN	13,360,000
Four-product stocks	40,413,000	UP	6,094,000	DOWN	10,441,000
Total imports	1,808,300	UP	351,300	UP	345,500





Active Rotary Rigs

	8-8-60	8-1-60	8-10-59
Alabama	4	4	10
Alaska	7	7	(†)
Arkansas	12	12	14
Arizona	1	1	1
California	78	78	93
Land	76	76	90
Offshore	2	2	3
Colorado	36	39	64
Florida	2	2	1
Land	2	2	0
Offshore	0	0	1
Illinois	41	40	39
Indiana	13	15	6
Iowa	0	0	2
Kansas	106	109	134
Kentucky	2	3	9
Louisiana	301	290	351
North	46	39	47
S. Inland waters	115	110	137
S. Land	85	82	115
Offshore	55	59	52
Maryland	1	1	0
Michigan	48	43	28
Mississippi	63	57	70
Missouri	1	1	1
Montana	22	20	31
Nebraska	28	25	22
Nevada	0	0	1
New Mexico	105	110	111
New York	0	0	1
North Dakota	16	13	27
Ohio	5	5	4
Oklahoma	165	150	230
Oregon	1	1	10
Pennsylvania	13	10	5
South Dakota	0	0	0
Texas	560	558	772
S. Inland waters	3	4	8
S. Land	171	162	206
Offshore	0	1	2
North	42	48	149
Panhandle	45	46	(*)
East	41	41	(*)
West Central	158	158	258
West	100	98	149
Utah	26	27	35
Washington	1	1	2
West Virginia	4	4	10
Wyoming	66	73	76
Total U. S.	1,728	1,699	2,160
Western Canada	184	180	158
Eastern Canada	0	1	0
Grand total	1,912	1,880	2,318

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported 4-4-60.

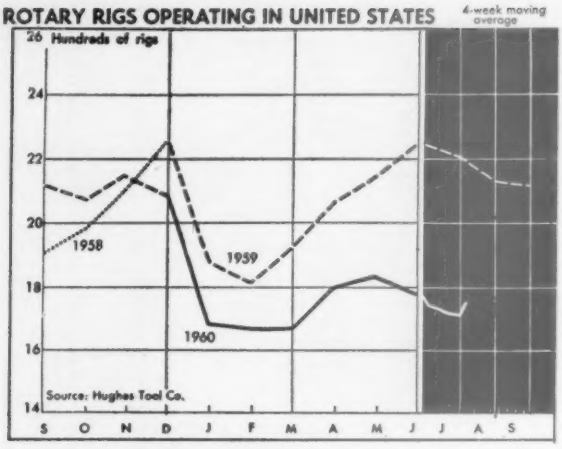
WEEKLY WELL COMPLETIONS . . . WEEK ENDED AUGUST 6, 1960

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	28	59	0	0	0	0	0	1	15
Arizona	5	2	0	0	3	0	13,003	25	.....	2	0	0	0	2	18	.....
Arkansas	7	4	0	1	2	0	27,596	363	504	2	0	0	1	1	99	88
California	33	20	0	4	9	0	117,164	986	911	12	1	0	2	9	182	224
Colorado	14	4	0	0	10	0	87,568	370	453	10	2	0	0	8	185	268
Illinois	58	19	0	0	29	10	127,504	1,247	1,309	14	4	0	0	10	266	214
Indiana	33	10	0	1	22	0	42,456	576	481	11	1	0	0	10	220	158
Kansas	49	19	0	3	25	2	175,744	1,897	2,394	14	3	0	0	11	619	561
Kentucky	64	5	0	15	14	30	125,266	1,010	1,509	2	1	0	0	1	113	127
Louisiana	78	34	6	7	31	0	565,712	2,072	2,175	11	0	0	0	11	328	289
North	35	15	0	6	14	0	111,109	757	800	7	0	0	0	7	156	116
South	33	14	5	1	13	0	338,326	1,012	1,141	3	0	0	0	3	150	162
Offshore	10	5	1	0	4	0	116,277	303	234	1	0	0	0	1	22	11
Michigan	23	12	0	0	9	2	77,496	502	369	5	0	0	0	5	140	90
Mississippi	12	6	0	0	6	0	126,649	420	375	7	1	0	0	6	156	173
Montana	9	1	0	0	8	0	42,947	180	191	6	0	0	0	6	88	60
Nebraska	18	4	0	0	14	0	95,710	508	517	8	0	0	0	8	213	221
New Mexico	37	14	1	17	5	0	187,299	1,099	1,201	2	0	0	0	2	169	143
West	19	2	1	15	1	0	101,251	367	547	1	0	0	0	1	40	43
East	18	12	0	2	4	0	86,048	732	654	1	0	0	0	1	129	100
New York	18	8	0	0	3	7	22,770	205	169	0	0	0	0	0	26	13
North Dakota	4	1	0	0	2	1	32,428	180	308	0	0	0	0	0	46	61
Ohio	22	10	0	0	12	0	43,559	596	573	1	0	0	0	1	33	15
Oklahoma	85	44	1	6	28	6	348,665	*2,795	3,511	15	2	1	0	12	457	514
Pennsylvania	0	0	0	0	0	0	0	377	323	0	0	0	0	0	8	9
South Dakota	0	0	0	0	0	0	0	17	.....	0	0	0	0	0	6	.....
Texas	309	149	24	11	113	12	1,356,870	9,510	11,500	71	8	1	0	62	1,975	2,144
Dist. 1	17	9	1	0	7	0	44,005	651	676	4	0	0	0	4	248	189
Dist. 2	12	1	3	0	8	0	91,629	451	486	4	0	0	0	4	110	141
Dist. 3	25	12	5	2	6	0	202,971	734	717	8	3	0	0	5	139	147
Dist. 4	19	4	6	2	7	0	120,686	640	800	3	0	1	0	2	182	193
East	33	19	2	0	12	0	147,181	765	722	7	0	0	0	7	161	140
Dist. 7-B	58	22	0	0	35	1	131,692	1,389	1,570	19	2	0	0	17	392	412
West	79	45	5	1	21	7	403,221	2,508	3,556	16	3	0	0	13	395	490
Dist. 9	44	26	0	0	14	4	114,970	1,750	2,164	9	0	0	0	9	308	365
Dist. 10	22	11	2	6	3	0	100,515	622	809	1	0	0	0	1	40	67
Utah	5	2	0	1	2	0	30,587	156	196	2	0	0	1	1	54	53
West Virginia	0	0	0	0	0	0	0	471	456	0	0	0	0	0	4	15
Wyoming	26	13	0	1	12	0	139,566	619	574	12	1	0	1	10	251	192
Misc. (Mo.)	1	0	0	0	1	0	3,408	89	77	1	0	0	0	1	81	45
Total U. S.	910	381	32	67	360	70	3,789,967	*26,298	30,124	208	24	2	5	177	5,738	5,692
Prev. week	937	370	25	103	378	61	3,844,432	.....	.....	216	25	2	8	181	.....	.....
Cum. 1960	*26,298	12,127	790	2,141	10,216	1,024	112,758,757	.....	.....	5,738	513	64	187	4,974	.....	.....
Cum. 1959	30,124	15,249	747	2,177	11,143	808	124,891,388	.....	.....	5,692	543	79	169	4,901	.....	.....
Western Canada	100	60	0	15	21	4	499,629	1,351	1,519	21	3	0	5	13	370	445

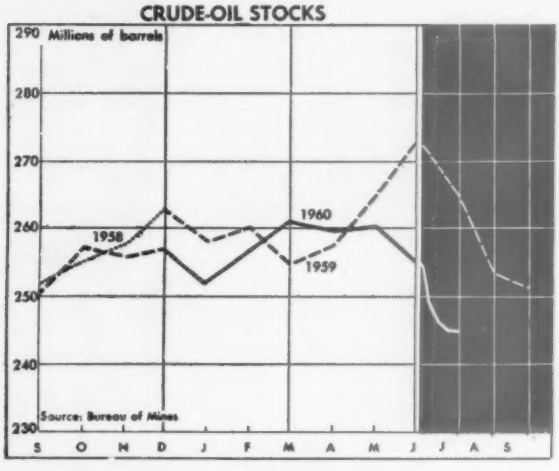
*Incl. 381 wells completed in Northeast Oklahoma from Jan.-Aug. 1, as reported to Oklahoma Corporation Commission.

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	7-30-60	7-23-60	8-1-59
Pennsylvania	2,201	2,156	2,502
Other Appalachian	1,768	1,881	2,001
Illinois, Indiana, Michigan	9,201	9,300	9,558
Nebraska and North Dakota	2,668	2,922	2,867
Kansas	9,028	9,300	9,994
Oklahoma	16,767	17,210	16,696
Arkansas	1,845	1,923	2,046
Louisiana	17,738	17,535	18,915
North	3,127	2,886	3,193
South	14,611	14,649	15,722
Mississippi, Alabama, Florida	2,286	2,458	2,560
New Mexico	8,244	7,925	7,587
Texas	102,420	103,865	116,617
East Texas	8,312	8,157	9,102
West Texas	47,656	48,047	54,958
Texas Gulf	16,700	17,260	19,888
Other Texas	29,752	30,401	32,669
Wyoming	16,846	16,668	15,016
Other Rocky Mountain	10,367	9,916	9,689
California	27,978	28,120	31,607
Foreign	†13,464	13,737	16,037
Total	**242,821**	244,916	263,692

*Bureau of Mines. †Includes 2,600,000 bbl. in California.

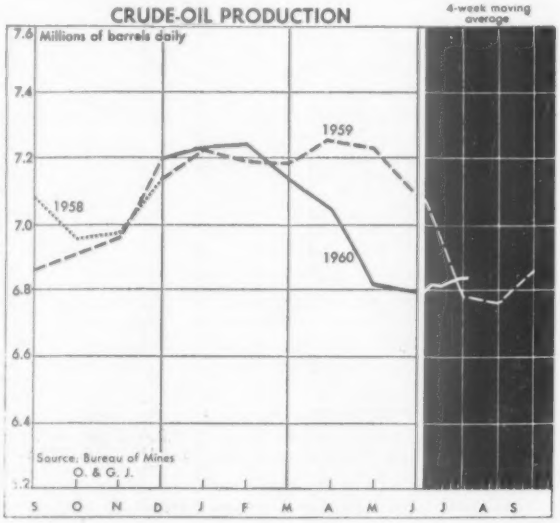
DAILY AVERAGE PRODUCTION FOR WEEK

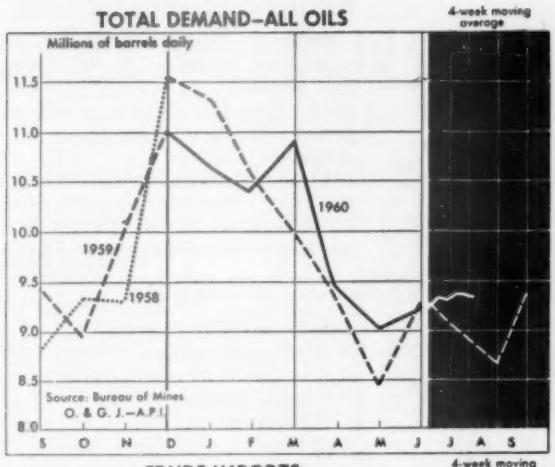
	August 6, 1960			July 30
	Crude oil	Lease condensate	Total	total
Alabama	16,000	.....	16,000	15,975
Arkansas	81,785	215	82,000	82,000
California	837,600	.....	837,600	838,000
Colorado	130,100	.....	130,100	128,700
Eastern	41,000	.....	41,000	39,800
Florida	1,000	.....	1,000	1,000
Illinois	219,300	.....	219,300	219,600
Indiana	33,100	.....	33,100	33,100
Kansas	†294,215	.....	†294,215	†295,900
Kentucky	63,600	.....	63,600	63,400
Louisiana	945,450	120,650	1,066,100	1,059,300
North	105,175	5,650	110,825	110,800
South	840,275	115,000	955,275	948,500
Michigan	39,500	.....	39,500	41,500
Mississippi	131,575	3,450	135,025	137,600
Montana	82,100	.....	82,100	83,000
Nebraska	67,900	.....	67,900	66,800
Nevada	100	.....	100	100
New Mexico	288,275	6,700	294,975	291,000
North Dakota	64,000	.....	64,000	59,400
Oklahoma	†498,400	.....	†498,400	†492,200
Texas	2,352,575	85,250	2,437,825	2,434,800
Dist. 1	41,000	2,500	43,500	43,500
Dist. 2	96,300	8,100	104,400	105,100
Dist. 3	309,275	36,000	345,275	346,000
Dist. 4	164,575	14,450	179,025	178,000
Dist. 5	26,000	300	26,300	26,300
Dist. 6	104,575	9,800	114,375	109,900
East Texas field	122,000	.....	122,000	122,000
Dist. 7-B	127,425	125	127,550	126,150
Dist. 7-C	111,000	3,250	114,250	119,300
Dist. 8	950,425	8,000	958,425	956,000
Dist. 9	193,000	1,800	194,800	194,700
Dist. 10	107,000	925	107,925	107,850
Utah	87,200	.....	87,200	93,700
Wyoming	347,000	.....	347,000	349,300
Others	‡1,375	.....	‡1,375	‡1,250
Total U. S.	6,623,150	216,265	**6,839,415**	6,827,425
Change from previous week, up			**11,990**	.....
Canada	†547,000	.....	†547,000	†535,300

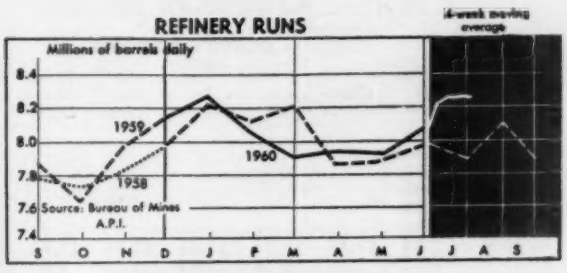
Total U. S. prod.—Jan. 1-Aug. 6 ..... 1,534,320,900 bbl.
Same period last year (crude plus cond.) ..... *1,553,125,600 bbl.

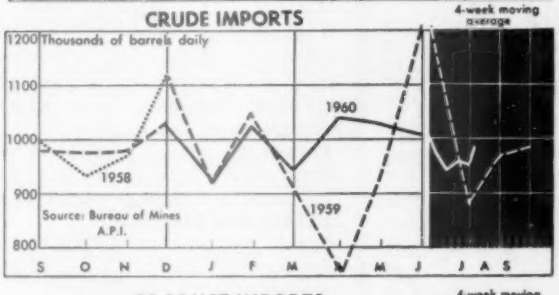
*Includes 41,133,400 bbl. condensate. †Week ended previous Monday. ‡Alaska, South Dakota, and Arizona.

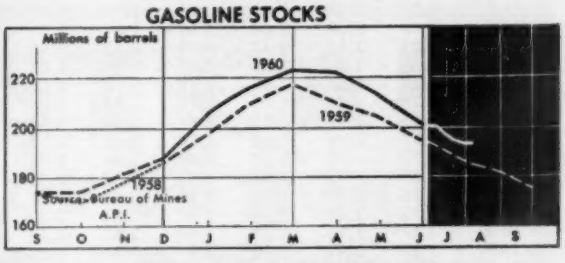
CRUDE-OIL PRODUCTION

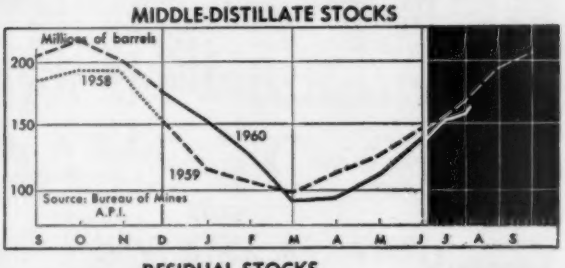


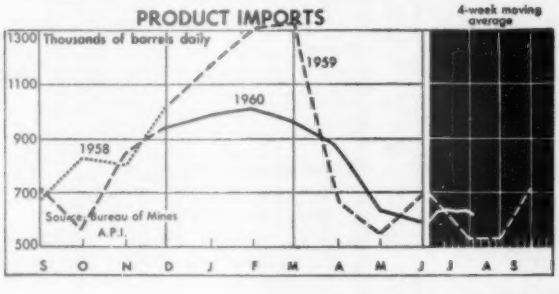


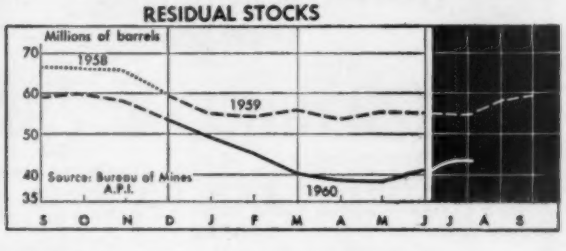












API REFINERY REPORT—AUGUST 5, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, August 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,137	545.0	45.9	325.7	147.9	45,280	11,889	48,125	11,564	1,150	547.8	27.0	328.3	146.8
Appalachian:														
District 1	85	38.3	2.7	26.1	5.1	6,086	716	2,897	407	93	41.2	2.7	21.8	6.0
District 2	108	50.6	6.9	19.1	11.1	3,040	377	1,473	258	105	58.9	1.6	18.8	8.5
Ind., Ill., Ky.	1,492	765.4	62.0	337.0	138.6	33,296	6,215	22,739	5,421	1,436	772.0	53.8	298.9	125.2
Minn., Wis., Dak.	133	63.3	7.1	31.6	16.4	6,211	1,411	6,522	545	102	50.7	2.8	27.6	9.9
Okla., Kans., Mo.	733	403.4	9.0	176.9	18.6	17,024	1,581	11,371	1,015	719	393.3	7.0	175.2	18.9
Inland Texas	315	221.9	9.0	56.1	18.0	6,697	587	1,845	2,479	306	226.7	7.2	52.0	21.8
Tex. Gulf Coast	2,008	991.4	121.8	442.1	139.5	24,703	3,311	14,528	4,721	1,843	958.3	77.3	446.3	168.9
La. Gulf Coast	644	340.0	45.6	153.4	39.6	10,327	1,955	6,054	1,518	717	385.0	48.0	172.3	51.0
N. La. and Ark.	103	55.4	6.7	18.6	5.0	5,885	852	2,302	131	67	27.3	2.0	13.6	5.1
Rocky Mountain:														
New Mexico	25	12.1	0.6	4.7	3.1	549	37	175	10	27	14.1	0.4	5.5	2.0
Other Rky. Mt.	310	143.1	4.4	61.3	36.3	5,702	379	2,580	821	318	148.2	2.0	62.9	34.0
West Coast	1,178	518.7	34.3	186.4	250.1	28,847	1,392	13,798	14,125	1,198	542.4	2.5	180.7	285.5
Aug. 5, 1960	8,271	4,148.6	356.0	1,839.0	829.3	193,647	30,702	134,049	43,015	8,081	4,165.9	234.3	1,803.9	883.6
July 29, 1960	8,290	4,144.9	346.3	1,862.0	799.7	193,195	29,797	128,941	43,386	.....	.....	.....	.....	.....
Aug. 7, 1959	7,836	4,023.9	205.1	1,773.6	879.0	183,481	29,004	142,994	56,375	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.76	....	....	....	....	....	....	....	....
15-15.9	1.84	....	....	....	....	....	....	....	$1.81
16-16.9	1.92	....	....	....	....	....	....	....	1.86
17-17.9	2.00	....	....	....	....	....	....	....	1.91
18-18.9	2.08	....	....	....	....	....	....	....	1.96
19-19.9	2.16	....	....	....	....	....	....	....	2.01
20-20.9	2.24	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.32	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.39	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:
Sweet Lake $3.00

Texas:
East Texas 3.05-3.25
Conroe 3.23-3.53
Van 3.08

Pennsylvania Grade:
Bradford $4.75-4.80
Middle District 4.52
Southwest Pennsylvania 4.25
West Virginia 4.17
Buckeye Grade 4.08

Illinois Basin **2.85-3.00**

Foreign

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)
★ Arabian, 34.0°-34.9°, Ras Tanura $1.76-1.90
★ Iranian, 34.0°-34.9°, Bandar Mashur 1.74-1.86
★ Iranian, 34.0°-34.9°, Abadan 1.69-1.81
★ Iraq, 35.0°-35.9, Fao .. 1.68-1.80
★ Kuwait, 31.0°-31.9°, Mina-al-Ahmadi 1.58-1.67
★ Qatar, 41.0°-41.9°, Um Said 1.91-2.05

Middle East, E. Mediterranean:
★ Arabian, 34.0°-34.9°, Sidon $2.13-2.27
★ Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli 2.15-2.29

Far East (cargoes, f.o.b. Lutong, Sarawak):
Seria Light, 37° 2.57

Canada:
Leduc-Woodbend $2.53
Redwater (Alta.) 2.42
Smiley (Sask.) 2.18
Pembina 2.38

Venezuela:
Cumarebo, 47°-47.9°, Tucupido 3.34
San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
Oficina, 35°-35.9°, Puerto La Cruz 2.80
Tia Juana medium, 26°-26.9°, Amuay* 2.30
Quiriquire, 16.0°-16.4°, Caripito 2.10
Lagunillas heavy, flat, Las Piedras* 2.10
Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)
★ Gulf-NY, clean (ATRS+5.0%) $2.99
★ Gulf-NY, dirty (ATRS—30.0%) 2.00
Carib.-NY, dirty (ATRS—60.0%) 1.10
★ PG-UK, dirty (Scale—67.5%) (21s. 10d.) 3.05

★Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):
★ Regular (91 octane).. 12.25-12.50
★ Premium (99 octane). 15.00-15.25
Natural gasoline (26-70) 4.5
Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
Regular (90 octane) .. 11.00
Regular (92 octane) .. 11.25
Premium (98 octane).. 12.25

California (rack) Los Angeles:
Regular (88 octane) .. 11.65-12.15
Premium (94 octane). 12.65-13.15
Premium (100 octane) 14.00-14.65

Caribbean area (cargoes):
Regular (87 octane).. 10.125-10.25
Premium (97 octane). 11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):
★ Kerosine 42-44 ..... 9.625-9.875
Diesel oil (58 d.i. and above) 9.25-9.50
Distillate No. 1 ..... 9.25-9.50
Distillate No. 2 ..... 8.25-8.50

Gulf Coast (cargoes):
Kerosine 41-43 ..... 9.00-9.25
Distillate No. 2 ..... 8.25

New York Harbor (barges):
Kerosine 41-43 ..... 10.05
Distillate No. 2 ..... 9.05
Diesel fuel, 48-52 d.i. 9.35

Caribbean area (cargoes):
Distillate No. 2 ..... 8.125

Residual Fuel (Bbl.)

Mid-Continent (Group 3):
Residual fuel (max. 1% S) $1.90

Gulf Coast (cargoes):
Bunker C fuel 2.35

New York Harbor (barges):
Bunker C fuel 2.52

Caribbean (cargoes):
Bunker C $2.10

California (rack):
Bunker C fuel, Los Angeles $2.15

★Denotes change from previous week.

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IDECO H-40-D Double Drum Drawworks, with Automatic Catheads, 22" Hydratarder, Right Angle Rotary Drive, two Control Consols and #525 Input Shaft Powered by GMC 6-71 #12107 Twin, with Complete Safety Shut Downs and Alarms, 96' Ideco 240,000# Hook-Load Kwik Lift Mast, complete with Guylines, Platforms, Lights, and Hydraulic System for Raising and Lowering. All Mounted on 8 Wheel Ideco H. D. Rambler Trailer. Excellent Condition. Priced at $30,000.00 F.C.B. our Bakersfield Yard. Balance of additional necessary equipment to complete if desired. Contact E. W. Clark, c/o Bender Oil Operations, P.O. Box 52, Bakersfield, California. Telephone FAirview 4-4961.

MAYHEW 1000 DRILL UNIT
air-water combination mounted on 1955 R185 International truck. Also includes water truck with 700-gallon tank. Call or write:

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Limited Service Electricweld and A-252 Grade 2
12¾" x .188 Wall 12¾" x .281 Wall
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Plus
24" x .312 Wall Limited Service and A-252 Grade 2
20" x .312 Wall Limited Service and Structural Grade

These Double Random Length items are specially priced to offer you big savings. Available in large quantities, they're particularly suitable for medium pressure lines, and for structural applications such as pipe for piling, building columns, etc.

ALSO IMMEDIATE DELIVERY
Prime Tested Electricweld Line Pipe API 5L
10¾" x .188 Wall 6⅝" x .156 Wall
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all sizes and types

• TOWERS • CONDENSERS
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• VESSELS • BLOWERS
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7¼—14 (F x K) Gardner Denver, late type, skid mounted, Mud Pump. Power and Fluid ends like new. Completely gone through. 4 sets liners, extra valves, etc. Sand blasted and primed. Will paint your color. $7,500.00. Located in Billings, Call or write Luke Wise, Community Gas & Oil Co., Billings, Montana.

—PIPE—

2,000,000 ft.	2"	3.50# to the ft.
1,000,000 ft.	3"	7.70#
1,000,000 ft.	4"	10.98#
500,000 ft.	6"	19.80#
200,000 ft.	8 5/6"	28#
400,000 ft.	10¾"	35#
75,000 ft.	12¾"	40#
10,000 ft.	16"	42#

All No. 1 Grade plain end and cleaned.

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All Material Excellent Condition.

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9MM BTU/HR. Duty; 20' Stack
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3—100,000-barrel Cone Roof Tanks 134' dia. x 40' high, fabricated to API Specs, detailed prints available. Suitable oil, water, other liquid storage. Priced attractively prompt shipment Rome, New York.

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Steel Tube: 3280, 2100, 1200, 950 sq. ft.
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8' x 75' 20 Tray 25#	4' x 36' packed 210#
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3' x 47' 20 Tray 120#	6' x 42' 200#
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2—IR Turbo Exhausters 15,300 & 17,000 CFM 4.85 PSIG with Turbine Drives.
1—Clark Centrifugal Compressor 10,000 CFM—240 PSI discharge.

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15 Storage Tanks welded: 29,000, 10,000, 5,000, 3,750 barrel.
5 Spheres-Spheroids: 5,000, 10,000 barrel.

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Hot Oil: 1" through 6"; 50-400 gpm 100-3,000 ft. hd.
Boiler Feed: 190 gpm 1,500' hd.
Cooling Tower: 7,000 gpm 120' hd.
River Water Sump: 1,000 gpm 59' hd.
Deep Well: 1,700 gpm 90' hd.

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2 Petro-Chem. Furnace: 1¼ mil. BTU
2 B&W Boilers: 70,000# per hr.-450#
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1 Worth LT-6 Compressor
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75,000'—2⅜" x 4.6#, R-2, 49¢ ft.
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Tested 3000#, drifted, with new collars, threads, and steel thread protectors to meet API specifications (4000# test at slight additional charge).

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Tulsa, Oklahoma

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Tulsa, Oklahoma

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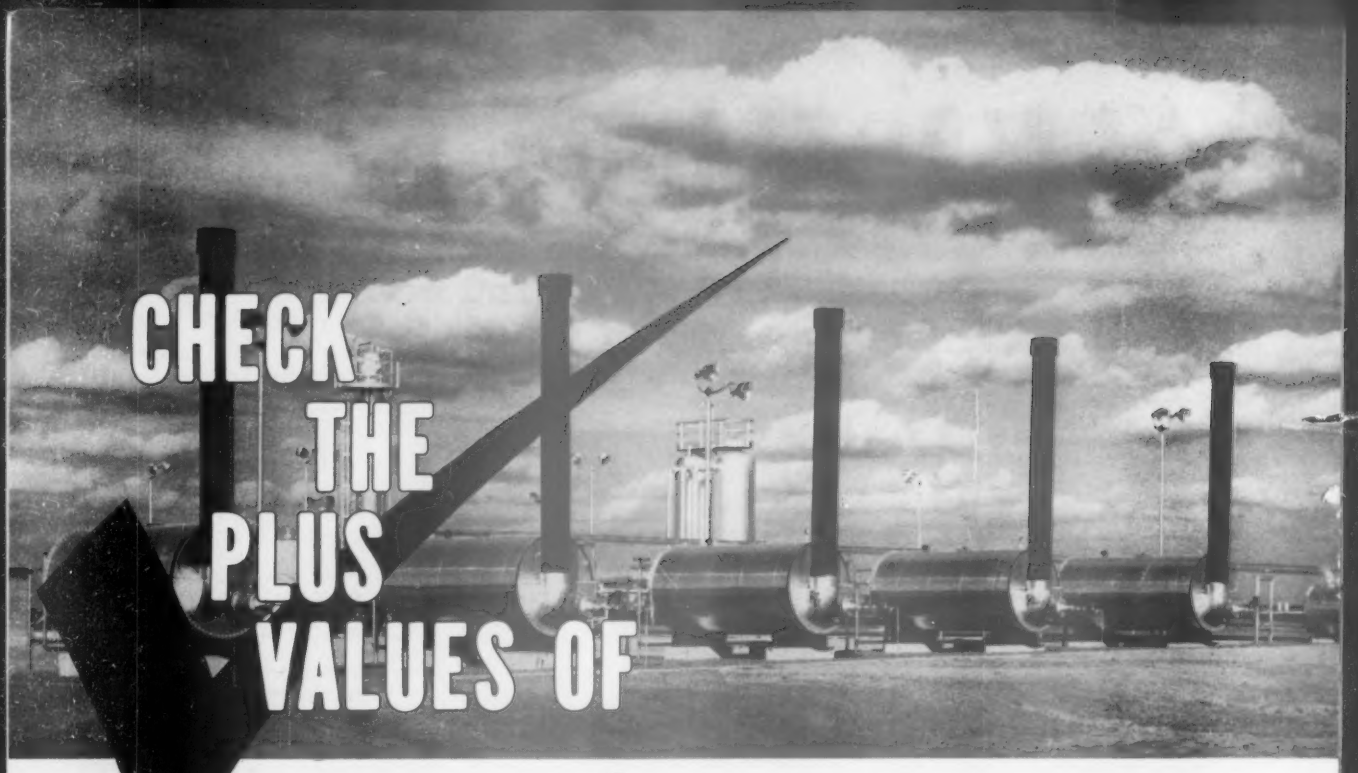

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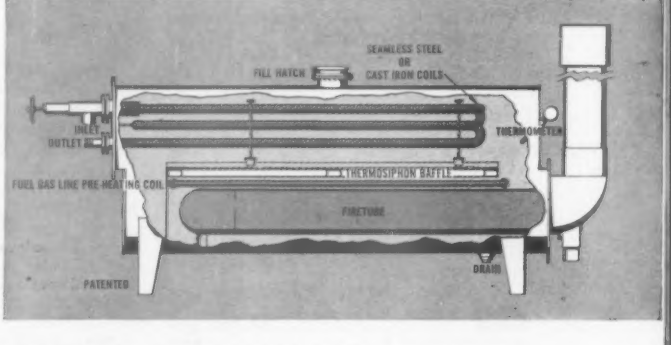

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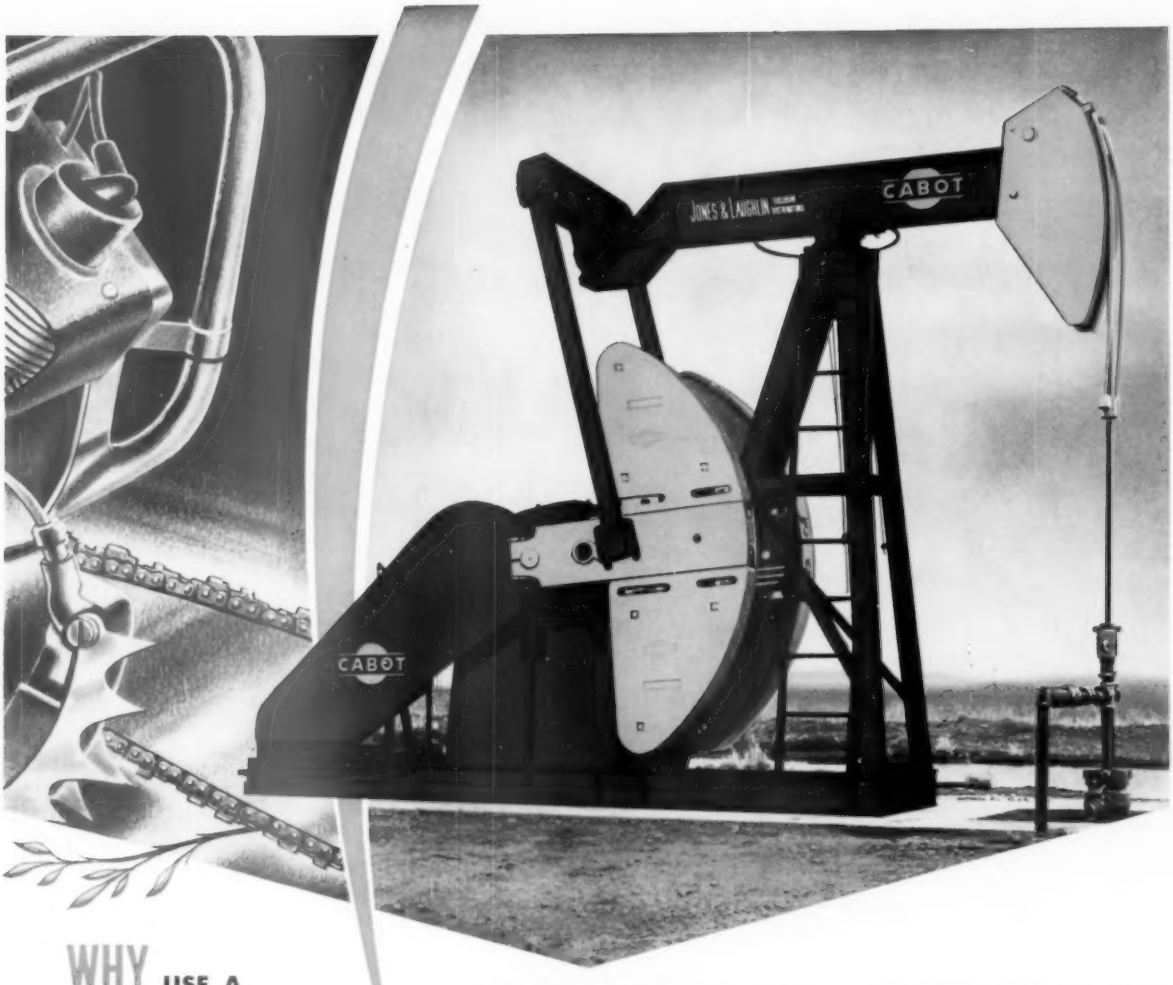

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